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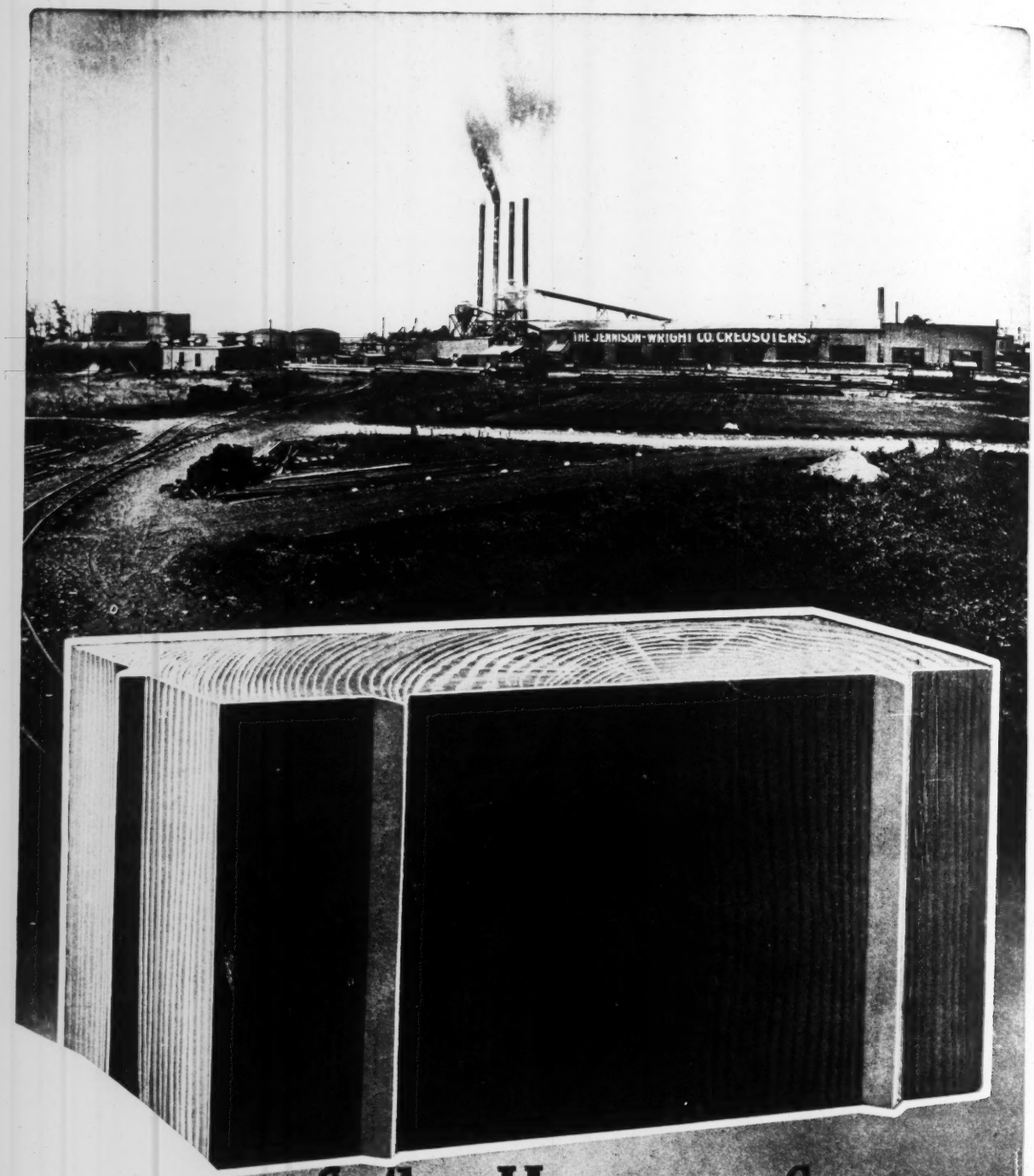

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Paving that's Saving"

OWAY TOLEDO, OHIO.

Volume 81 October 31, 1918 *Number 18*

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A CONSOLIDATION OF ENGINEERING NEWS AND ENGINEERING RECORD, WITH WHICH IS INCORPORATED THE CONTRACTOR.

E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

Shipbuilding Methods of the "Eagle" Chaser Factory 788

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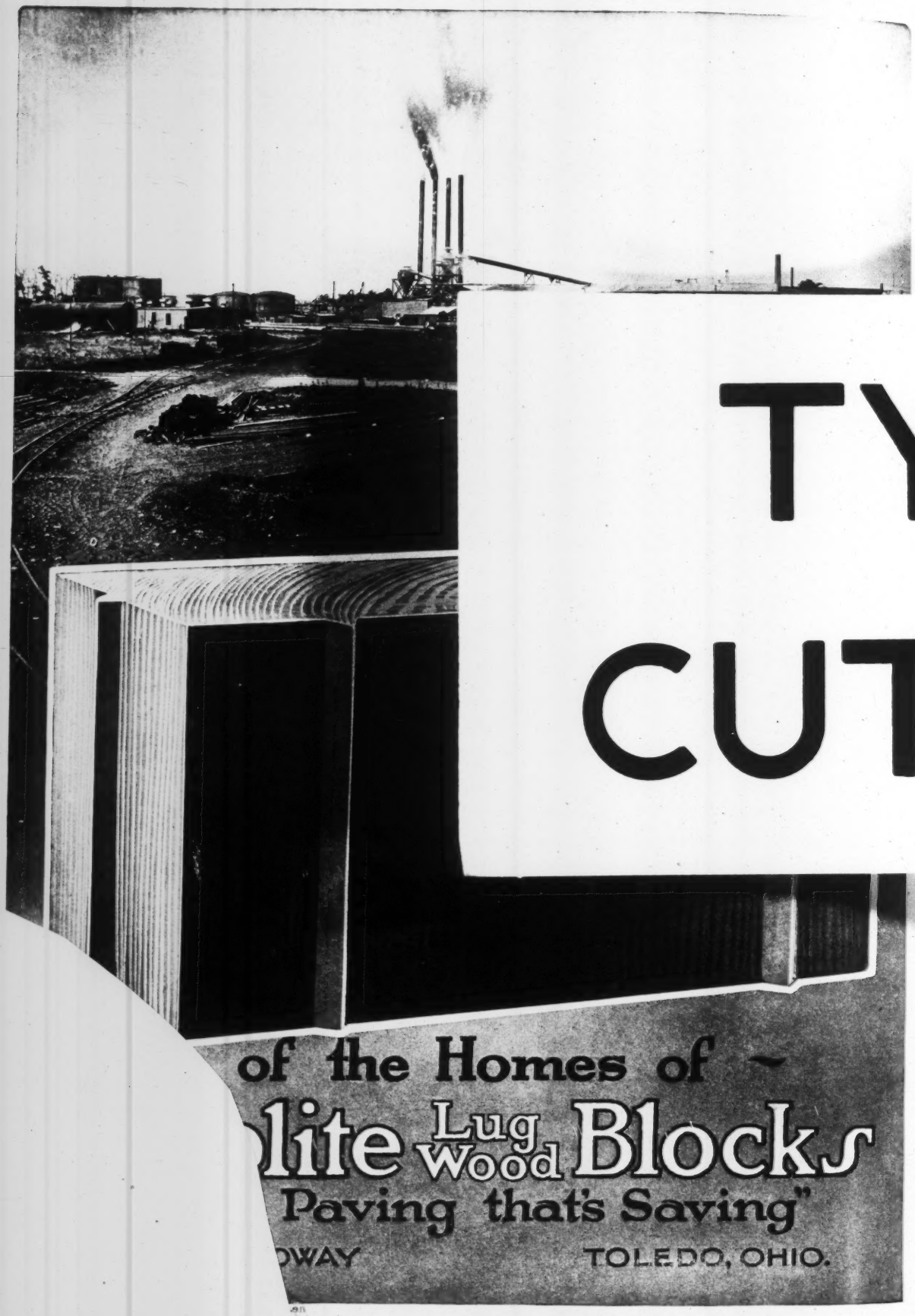
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To Concrete Contractors:

THE conservation and proper distribution of labor is necessary to help win the war. We can save 80% of the labor on your bending by doing the work in our shops on power machines instead of doing the work in the eld, and it will cost you less money, as well as save time.

By using bar-tys, ty-chairs and other concrete specialties manufactured by us, you will also conserve labor, and at the same time save money. Let us tell you more about our time- and labor-saving devices.

CONCRETE STEEL COMPANY

42 Broadway, New York

Boston Philadelphia Birmingham Chicago Cleveland Detroit Syracuse

W. B. Mayo, chief engineer of the Ford Motor Co., is credited with originating the idea of lowering the finished hulls into the water by a vertically moving hydraulic elevator. Carried out with remarkable excellence of detail, the scheme has proved completely successful.

This platform is a steel truss bridge 200 ft. long, supported at the quarter points of its length by two transverse trusses whose ends, 14 ft. out from the bridge trusses, are attached to two vertical 4-in. hanger rods, which are the piston rods of vertical hydraulic cylinders. Concrete pedestals 8 ft. high above water support these cylinders; the deep slot between the two pedestals of each pair, extending to the bottom of the slip under the bridge, gives space for the ends of the cross-frames of the bridge as the lowering proceeds.

In the operating house, on the bank alongside the launching platform, is a duplex high-pressure pump furnishing water at pressures up to 500 lb. A control stand with four pairs of valves provides for independent operation of the eight cylinders, but an ingenious dial indicator directly in front of the control stand shows by four separate hands the position of each pair of pistons and of the center point of the platform. The operator is able to keep the platform level within ¼ in. About 30 minutes' time is required for the complete launch.

Two mechanical safety devices are embodied in the launching platform construction. To take the weight of the empty structure when in its normal (upper) position, a supporting girder is placed under each end, bridging the width of the gap between lateral forward extensions of the abutment pier. This girder can be pulled back out of the way—after the platform is raised an inch or two—by pulling-screws engaging the ends of the girder and a pair of upward-projecting lugs fastened to the back of the abutment. Further, locking bolts pass through links in the eight piston-rod hangers. The pistons cannot be lowered until these bolts are withdrawn. Two hand levers at each pair of cylinders are provided to actuate the bolts.

Systematization in the Fitting-Out Plant

Saving labor and time in the fitting-out operation is accomplished by virtue of the progressive system of layout and working, with little aid from mechanical appliances. The work of installing the machinery and fittings of the ship and placing its many pieces of equipment is broken up into a succession of segregated items, carried out in seven consecutive positions of the ship alongside the 2000-ft. fitting-out dock.

To characterize the arrangement of these operations, the following partial schedule of items performed at its seven stations (stations 9 to 15) is quoted:

Installing boilers, uptake and mounting is the principal piece of work at station 9. The deck over the boilers is riveted, boiler piping and a considerable amount of other interior installation are placed, and anchors and windlass are added to the ship. At station 10 the steam turbine and its reduction gear are set, shafting and the bulk of all the piping are installed, the chief electrical work in the ship is done, and the stack is set. Most of the furring is placed at station 11, and the air test of various compartments is made. At station 12 many

FIG. 8. WORK ON THE FIRST "EAGLE" IN PROGRESS LAST MAY

items of rigging are put in place, from ventilating cowls to masts, spars and davits; fire extinguishers, whistle, plumbing fixtures and radiators are set, and the ice machine is put into the ship. Some electrical work is also done at this station. Other items of equipment and part of the naval installation are set in place at stations 13 and 14. Making the ship ready for sea begins at station 14 with loading the fuel-oil tanks. At station 15 the final items in this part of the work are performed, including raising steam and testing the piping.

Long sheds built on the fitting-out dock, some 20 ft. inshore of its face, supply the materials and equipment in corresponding order. A locomotive crane running on a track on the dock in front of the sheds handles the material into the ship.

Ford factory methods find application in a special rig used at the first of the seven stations, where turbines and boilers are installed in the ship. It serves for assembling the boilers, which arrive as drum-and-tube units without casing. The steel plate and firebrick casing must be built up around the steam element before the boiler is transferred to the ship. For this work an assembly skidway is provided in the shed. It consists of a pair of I-beam rails mounted on low concrete pedestals, and extends about 100 ft. longitudinally

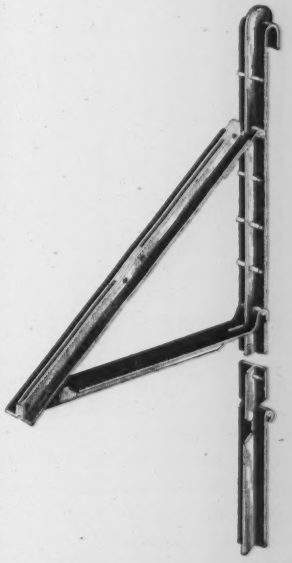

FIG. 9. HANGERS FOR RIVETING SCAFFOLDS

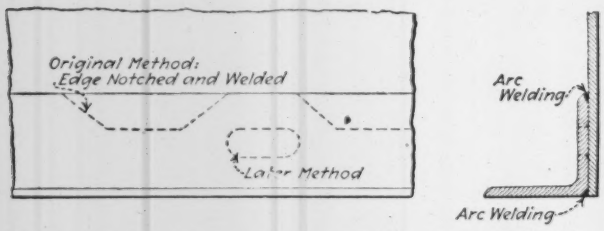

FIG. 10. ELECTRIC WELDING APPLIED TO BULKHEADS AND DECKHOUSES OF "EAGLES"

down the shed, Fig. 13. The boiler casings are built on small flat-wheeled carriages running on the skidway, as sketched.

Starting at the middle of the length of the skidway, the boilers are built up progressively and are shifted step by step toward the ends, going to different workmen for successive operations in the assembly. They reach the ends of the skidway in finished form, and here are run out through a door in the front of the shed by

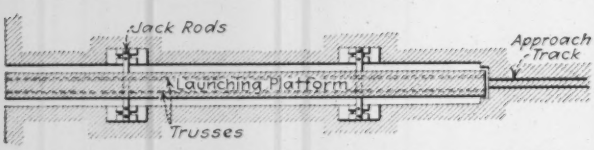

FIG. 11. LAUNCHING PLATFORM SUPPORTED BY EIGHT HYDRAULIC CYLINDERS

means of a transfer table composed of a length of skidway mounted on wheels. With ideal working of the system the two boilers required for a ship are started simultaneously at the middle of the skidway and, several days later, are completed and pass out of the shed at the same time, so that they can be set in the ship during its one-day stay at that station.

Supply of hull material to the "Eagle" plant is provided for by a punch shop that is easily among the largest in the world. As early as two months ago this plant was turning out material at the rate of 160 tons per day. On the basis of completing one "Eagle" daily, the ultimate production of this shop will be about 200 tons, a production that is being approached rapidly. Because the "Eagle" plating is only one-third to one-fourth as thick as that of steel merchant ships, the capacity of the shop in terms of ordinary ship material is 600 to 700 tons per day, or 15,000 to 20,000 tons a month.

Multiple punching is the basis of the shop equipment. When the work in the designing room had demonstrated that a large part of the shell and deck plating of the ship could be multiple-punched, ten machines for the work were fitted up from sheet-metal punch presses of the Ford Motor Co.'s automobile works. Thomas spacing tables were added at the feeding-out side, and the necessary gangs of punches with gag levers were built into the frames.

The shop is a timber-frame building about 100 x 450 ft., its long dimension set across the direction of travel of the material. At its rear, facing the storage yard, a lean-to 60 ft. wide extending all the way across the building provides space for marking out and for a considerable amount of single punching. There is a smaller lean-to on the opposite or forward side of the building.

In the storage yard back of the punch shop the plates are piled flat (not set in racks) and many of them are handled into the shop by hand. Locomotive-crane tracks traverse the yards at right angles to the longitudinal alignment of the plant, to place material in storage from cars, or to assist in handling it into the shop.

In the rear lean-to of the punch shop are installed eight single punches, two plate shears and one circle-cutting shear. Most of the space of this lean-to, however, is devoted to marking the single-punched plates, which is done by center punching through metal templets. These templets are stored in racks alongside the punch table. Material passes forward from here on small hand trucks and roller beds to the punches in the main building.

In the shop itself, the multiple punches dominate the arrangement. There are seven plate multiples, most of them of 72-in. gap. The plates to be punched average about 50 in. in width and usually require a gang of about 24 punches; they are fed through by hand. In addition there are three narrow multiples, eight single punches, one angle shear and punch, one blocking-out press, a horizontal punch for curved angles, two plate benders (flangers), one set of bending-rolls, a pair of small furnaces with bending slabs adjacent, and a row

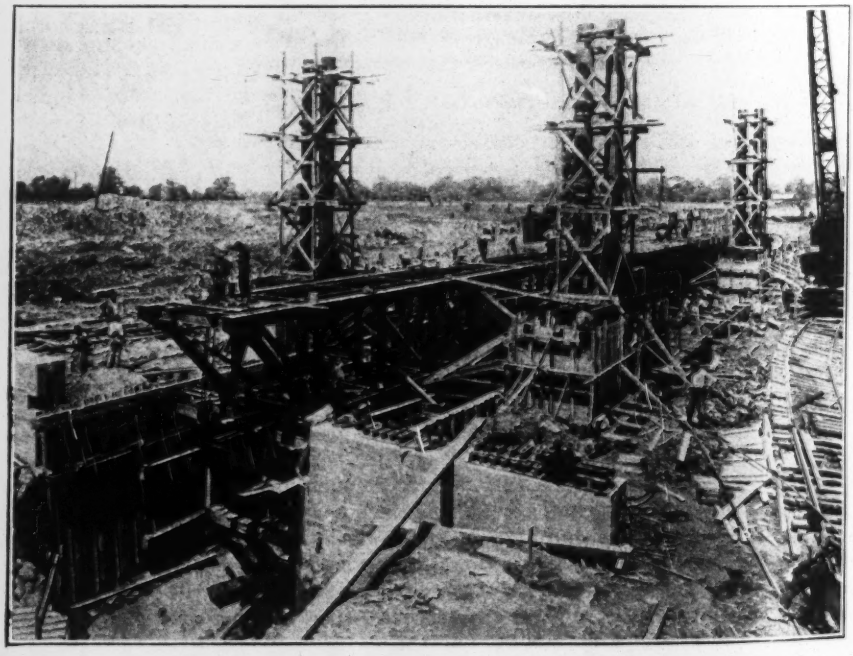

FIG. 12. LAUNCHING PLATFORM AND HYDRAULIC JACKS DURING CONSTRUCTION

of blacksmith forges. In the shed on the outgoing side of the punch shop are two plate-edge shears.

No storage space for finished material is provided at this shop. The outgoing material is handled directly on small railway trucks into the assembly shop, where it is taken down the supply bays to storage adjacent to the station where required for erection.

A New Automatic Spacer

An important improvement is being made in the punching of narrow plates and frames by the use of a special automatic spacer, capable of dealing with plates not ordinarily adapted to multiple-punch work. This ingenious device, originated by Joseph Dorschel, superintendent of the shop, punches plates in which the transverse lines of holes are not exactly at right angles to the longitudinal axis of the plate.

Between the rails of the feeding-out bed of the press is laid a metal pattern over which rides a small carriage attached to the leading end of the plate to be punched. A handle on this carriage serves for pulling the work plate forward through the punch. A transverse row of small vertical plungers or detector fingers is spring-mounted in this carriage, and adapted to enter holes in the pattern. As the work plate is pulled forward, one of these fingers dropping into the hole in the pattern stops the work. At the same time the punch operator sees the end of this finger depressed, and he pulls the corresponding gag lever of the punch, thereby producing a hole in the work plate corresponding in location to that of the pattern. As he does this, the feeder lifts the pulling lever, thereby disengaging the depressed finger, and pulls the work forward until another finger finds a hole in the pattern. By this arrangement, punching of holes irregularly arranged along several longitudinal lines is easily done, with accurate spacing; marking out is eliminated.

Working Force at the "Eagle" Plant

Estimates of operating organization call for a total force of about 11,000 men to operate the "Eagle" plant. The probable ultimate force will include about 9000 men in hull construction, and something more than 1000 in the steam-engineering work. A labor force of about 100 per station of the assembly shop will be required in each shift.

Work is carried on continuously through the 24 hours in three shifts—day shift 7 to 3, evening shift 3 to 11, and night shift 11 to 7. The day-shift force is one-third larger than those of the other two shifts.

Riveters have been the main problem of the "Eagle" plant, as they have of regular shipyards. In the words of William Knudsen, superintendent of the plant: "We know we can punch 200 tons per day, and we know we can erect 200 tons per day; the pinch is in riveting. We are now driving 86,000 rivets per day at the maximum [this was in September.—Editor], and we want to reach 240,000 rivets per day. We are putting on green men at the rate of 10 gangs per day, training them in the assembly riveting for final transfer to riveting on the hulls. An ultimate force of about 500 gangs of riveters is needed."

Considerable help was given to the organization of the plant by the transfer of about 40 skilled shipbuilders from United States navy yards, to act as instructors and help develop the working organization.

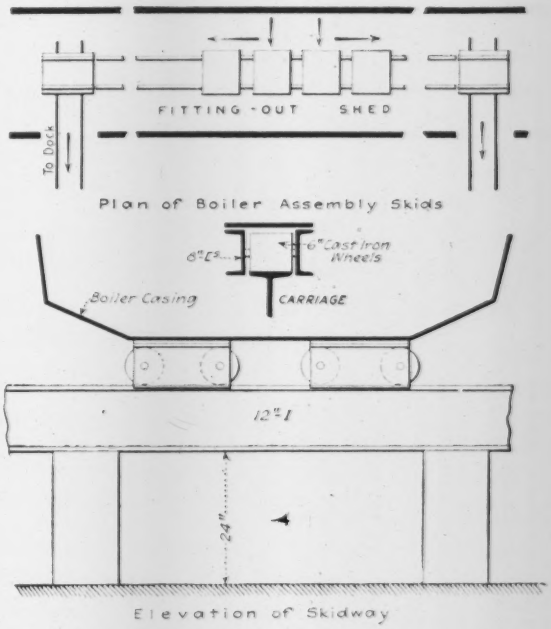

FIG. 13. FORD CONVEYOR-ASSEMBLY SYSTEM IN BOILER SKIDWAY

An outstanding feature of the organizing work is that hull construction did not begin until May 1, and that within four months from this time an organization of 6000 had been created and was successfully producing "Eagles." Almost none of the entire force had prior shipyard experience. The building up of this great working force proceeded in spite of the fact that no housing facilities are available locally, and, when construction began, the nearest street-car line was about a mile from the yard. Since that time special provision has been made for transporting men to their work, and recently a street-car line has been extended directly to the plant.

New Water-Power Project in California

A permit recently granted to the Southern California Edison Co. by the California Water Commission paves the way for an improvement to cost approximately $1,000,000. The permit approves the direct diversion and storage in Huntington Lake of the waters of Pitman Creek and the storage of 3781 acre-feet annually in Pitman Creek reservoir for the development of electric power. It is proposed to construct at Pitman Creek reservoir a dam 103 ft. high, 860 ft. long on top and 50 ft. long at the bottom. This structure would be of reinforced concrete, of the multiple-arch type, and the estimated cost of the dam and the conduit line to Huntington Lake would be $855,000. Two plants have already been installed on Big Creek, known as Big Creek Power Plants Nos. 1 and 2, and it is proposed to construct two additional plants below these. The water, after being used in all the plants, is to be returned to the San Joaquin River from the tailrace of Plant No. 4 in Madera County. Construction work is to be completed on or before July 21, 1921.

Does the Engineer Make a Good Railroad Operator?

Views of Men Who Have Run Railroads as to Whether Engineering Training Helps or Hinders in Broader Railroad Work

By C. W. Stark
Associate Editor, Engineering News-Record

IS ENGINEERING a good training school for the railroad operating executive? Do engineering education and practice tend to develop the essential qualities of the successful transportation man, or do they narrow and so disqualify men for that service, or, finally, do the characteristics of the man govern wholly, irrespective of the training?

Some weeks ago a man high up in the Railroad Administration told the writer that one large trunk line in the East had stood out last winter, in comparison with all other roads, in the way it kept its line open, and that the reason for its success was that it was "run by transportation men and not by engineers"; and, on the other hand, that another large road had failed dismally in the emergency because it was run by engineers. As a personal opinion this charge need not, perhaps, be taken too seriously; but the writer, remembering that there were three engineers on the Railroads' War Board who were summarily dismissed when the Government took the reins, feared that there was a distinct feeling against engineers in the administration, and determined to solicit the views of railroad officials as to whether such a distrust was warranted. The subsequent appointment of engineers to two of the seven regional directorships, and of at least six engineers to important Federal managerships, indicates, happily for our profession, that there is no absolute conviction at Washington that we are unfit; but a summary of the opinions of the officials the writer has interviewed may nevertheless be of interest.

Four Outstanding Thoughts

Four conclusions stand out as the consensus of opinion of the men interviewed: First, and most important, that the engineering training and point of view are very desirable for the operating executive; second, that almost everything depends on the man, so that it is equally a mistake to promote him solely because he is an engineer or to condemn him for the same reason; third, that there is a danger that close confinement to technical problems may restrict the engineer's vision, examples being seen in the men who, with unimpeachable technical records, have failed utterly when tried on administrative work—computers to the *n*th degree, but not engineers, if engineering means skillful and economical production; fourth—and this seems to fit exactly with Dr. Charles R. Mann's views—that there is considerable opportunity for improvement in engineering education in order to develop in the engineer a better grasp of the human factors—a realization that engineering is not all, or even mainly, technical. And most encouraging was the writer's discovery that the men in the highest positions seemed surest of the value of the engineer's analytical methods in solving and handling transportation problems.

The opinions recorded include those of three railroad presidents, all of whom have served one or more large trunk lines and have played prominent parts in the railroad drama; the Federal manager of about 3000 miles of extremely important lines; a former general manager of an equally large mileage, and several lesser lights whose views are nevertheless highly respected by the writer.

When to Shift to Operation

Executives who had risen from the engineering ranks naturally came to the writer's mind when he considered whose views to solicit. One of these was the president of an Eastern railroad. He began in the maintenance department of another road, was division engineer and then division superintendent. He believed in engineering training as preparation for the responsibilites of railroad operation, thought the engineer's powers of analysis valuable in such work, but felt that most depended on the man. He thought it entirely possible to follow such a course as he had done and qualify for a superintendency without previous transportation experience; but he regarded it as essential that the young engineer keep his eyes and ears open to pick up all the railroad information possible. On the time at which to shift from engineering to operation, be it said, there was not unanimity of opinion. Some thought the engigeering graduate after only a brief sojourn in engineering work should get into operation in a yardmaster's or trainmaster's office; others thought the Pennsylvania's plan of holding him to engineering work until he had reached the post of division engineer gave him ample contact with the problems of keeping trains moving; a majority seemed to doubt the desirability of his remaining in engineering much beyond the division office if he hoped to absorb the fine points of railroading.

The general manager referred to thought that practically everything depended on the man; that the right man would succeed and the wrong one fail, irrespective of whether either or both were engineers. He thought there might be a tendency, because in the pursuit of engineering the engineer is dealing with materials whose performances he computes or forecasts in a coldly scientific way, to fail in dealing with men, because of an attempt to treat them in the same cold-blooded manner. On the other hand this man, who had been chief engineer, was glad he had been trained as an engineer, and thought that training of much service in his present work. In short, his view, like that of others, was that engineering training tends to make narrow men narrower and less useful for large railroad problems, and broad men broader and better fitted to solve them.

Finance, Banking and Business in General

One of the picturesquely independent thinkers in the railroad world, an engineer president who has remained with his corporation, testified to a faith in engineers that has grown constantly in the forty years of his association with them. Not only railroad operation, but railroad finance, banking and business in general he thinks need the viewpoint, the powers of analysis of the engineer. His confidence in the engineer was the more impressive because he has little faith in the lawyer and

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AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

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Planning For Future Needs

NEW prospects opening each day in the world's rapid progress lay ever-renewed emphasis on the necessity of planning for the morrow and beyond. Such planning, the engineering profession's chief duty, calls for utmost breadth of view. In past months these columns have pointed out time and again the urgent importance of thorough preparation for our country's and the world's war and post-war requirements. Though not more certain, the necessity becomes more obvious as cables, markets and public thought respond to rapidly fluctuating war and end-of-war anticipations. Whatever comes to pass, much planning must be ready for the hands of the doers if there is to be proper continuity of service to the world.

All the Reports Should Be Published

ANOTHER chapter in the history of sewage-treatment projects for Cleveland has been written. The question "Fine Screens or Imhoff Tanks?" discussed editorially in *Engineering News-Record* of Aug. 16, 1917, p. 290, is answered sweepingly in favor of the tanks, as is shown by extracts from Mr. Eddy's report on p. 800, of this issue. Even fine screens followed by activated-sludge treatment are advised against. A service to the engineering profession and to the municipalities of the country would be rendered by the publication in full of Mr. Eddy's report, and of a number of earlier reports dealing with projects for sewage treatment at Cleveland.

Only Washington Knows What is Essential Building

DECENTRALIZATION of the War Industries Board control of building, described on p. 811 of this issue, was a manifest necessity. Once it had been decided that all available building material must be diverted to war use some means had to be provided whereby the prospective builder would be saved the necessity of joining the Washington-bound crowds or of depending on the slender rod of the mails for a decision as to whether what he contemplated was or was not essential. So far as mechanism goes the state Councils of Defense had obvious advantages for agents of the board. They were in existence, were fairly well known and had had experience with the routine of dealing with Washington. Their main deficiency is in their dis-association from the war program. Only those in Washington close to war aims and war programs can decide upon the essentiality of any proposed construction which is not obviously and directly war work. So long as the state bodies refuse licenses to only the obviously unessential, and pass on to Washington the doubtful cases, the system will be effective. If some of them begin to take upon themselves the interpretation of broad questions of essentiality, the War Industries Board will be flooded with appeals and the mediation of the state councils will add to rather than subtract from the difficulties of the new building control.

Repair Economical Under War Conditions

ATTENTION to the repair and reinforcement of bridges and structures, as a means both of economy and of reducing the demand for material and labor for new structures in war time, was the keynote of extended discussions at the Chicago convention of the American Railway Bridge and Building Association. Complementary to this it may be suggested that many abandoned or useless buildings might be wrecked immediately in order to place idle material and equipment in use.

Luxury or Necessity?

WHETHER extensive corporate organizations for the railroads are necessary during the period of Government control seems to have been tacitly answered in the affirmative by the Government in one important case. With the separation of the corporate and operating activities of one of the country's greatest trunk lines the chief engineer and one of the two assistant chief engineers were taken over by the Railroad Administration. The other assistant chief engineer was in France, building railroads, with the commission of colonel. The president of the corporation felt that under the circumstances he simply had to have the colonel as corporate engineer, for the inspection and approval of plans and estimates for improvements and extensions, and for the verification of expenditures in connection with new work, as the costs of the improvements have to be financed by the corporation; and the negotiations that ensued resulted in the honorable release of the colonel from the United States Army. The stockholders doubtless see every reason why this action was necessary. One less in sympathy with the owners could easily assume that they would get their just deserts from the Railroad Administration in the natural

course of events, and that if they desired the luxury of a corporate engineer they must provide him without interfering in any way with war work. There is reason to doubt the wisdom of withdrawing from important duties in France a man who, we are informed, was by no means anxious to be so withdrawn, when so many other capable engineers in lesser positions were to be found on the same railroad; but the action of the Government in recognizing the company's plea for what it considered to be the best protection obtainable shows a commendable desire to be fair to the owners.

Shipbuilding Must Go Forward

WHILE fragmentary and conflicting, the news of its deliberations which the Shipping Board has permitted to go out into press channels during the past week was of such kind as to create anxious expectation and much doubt and uncertainty. Various indeed were the items of news, and none of them of such character as to hearten and stimulate the shipbuilders.

Building wooden ships was to end with the present contracts. Yards were to be closed because they had proved inefficient. Contracts would not be let at present because costs might decrease. Barge contracts were to be cancelled. Reduced steel allotments might be followed by transfers or modifications in steel ship contracts. Each single report was of a kind apt to discourage rather than encourage high-pressure driving of work in the shipyards.

A full clarifying statement from the Board is needed at the earliest possible moment. Subversive changes of policy are in danger of weakening most seriously the intense effort that is being applied to ship production. And just now we are in need of the highest attainable shipbuilding performance.

It would be hard to select a less appropriate time for thrifty speculations as to the possible influence of future cost levels on the shipping policy of today. Shipbuilding must go forward at undiminished speed. Reassurance from the Board concerning the developments at the past week's conference can not come too soon.

Fabrication in the Shipyard

FULLER description of the ship-manufacturing operations in the "Eagle" plant is given on pages 788 to 796 of this issue, supplementing the summarized sketch of the plant and its method printed two weeks ago. As pointed out at that time (page 697), the determining characteristic of the work at River Rouge is the application of factory system to ship construction. It now becomes clearly apparent that a special operating condition made this possible: continuous, full-capacity production of a standardized article.

Service of perfectly definite character was to be performed. Uniform production meant a steady flow of material through all departments, repetitive operations carried on at uniform rate, and standardization throughout. Here is the fundamental distinction between the Eagle plant and the conventional shipyard, where production varies in amount and kind, the flow of material is far from uniform both in direction and in rate, and detail processes are subject to change.

Yet there is an intimate analogy between the two. Considered as shipbuilding machines, they carry out identically the same functions in the same order; their radical dissimilarity in appearance only emphasizes the parallelism. They represent solutions of the same general problem approached from two different sides; the River Rouge plant is a single-purpose machine designed to operate, so to say, at a fixed number of revolutions per minute, while the other is a general-utility device.

Because of its specific service the plant placed a very definite problem before the designer. With operations adapted to fixed routine the consecutive departments could each be planned for definite performance. Laying out a shipyard, on the contrary, where the quantitative duty of no single department is known, is bound to depend on judgment.

Comparison of these two similar and yet different kinds of plant has marked interest in connection with one important development of this year's emergency shipbuilding. Fabricating capacity has proved to be the throttling point in virtually every shipyard; experience showed that berth and erecting capacity are well in excess of shop capacity. Not so in the Eagle plant; there the fabricating shop is easily able to supply the assembly unit under full-capacity operation. This of course is the natural result of designing for a definite plant output. So many ships per week were to be built; the shop had to supply just so much material ready for erection, and consequently required so much fabricating equipment. Proportioning shipyard shops proceeds by less exact methods. Moreover, it is based on operating conditions radically different from those of the present year.

Looking at the fabricating unit more broadly, however, the outstanding feature in any comparison is that the shop of the Eagle plant is a pure service element. Though of impressive size, it is in all respects a subsidiary department, dictating no phase of the assembly or subsequent operations. Placed at one end of the plant, operating under a fixed schedule, and delivering its output of prepared material by direct route, the shop is able to perform its supply function as regularly and unobtrusively as the feeder element of a smoothly working automatic machine. Here again the shipyard exhibits strikingly different conditions, the fabricating shop generally occupying a central position and dominating the yard operation rather than serving it. It is due to this state of affairs and to inadequate capacity that the expedient of bridge-shop fabrication assumed so great an importance in our new shipbuilding industry.

Present-time demands for the ultimate maximum of ship output have transformed the shipyard into a specialized plant operating at full speed. Temporarily every yard is a factory. Many points of equipment and organization have proved weak in this new service. In so far as rearrangement is necessary in order to meet the urgent call for ships, it must be in the direction of closer approximation to the factory type. Quite obviously it is not possible to relocate and rebuild fabricating shops in shipyards to resemble the specialized Eagle shop. Nevertheless, the subject of fabrication receives such remarkable illumination by this shop that the problems of both future and present shipyard service may benefit from its study.

New things are learned in these trying times of war service. Shipbuilding, though an old art, has also brought forth new knowledge. Men of broad outlook in the art acknowledge that within the past year they have learned better methods—learned how to increase yard economy and production. The years to come will show the result. With such a prospect it is not beyond the range of possibility that many problems of the shipyard may be restudied, and that the River Rouge plant may prove a guide to improved shop system.

Reflections on the Epidemic

INFLUENZA and pneumonia are still sweeping the country. Notwithstanding drastic measures of control these twin airborne diseases have spared neither camp nor city. What their death toll would have been under old-time conditions can only be imagined. Even now the U. S. Public Health reports show 21,096 deaths from influenza and 14,788 from pneumonia in 46 of the larger cities of the country between Sept. 7 and Oct. 19. For the period named the epidemic deaths raised the total death rate of these cities to an average of 60.4 per 1000 population on a yearly basis, while in Philadelphia for the week ending Oct. 19 the total death rate was 158.3 or some ten times the normal. In army camps up to Oct. 24 the deaths from the two diseases were 16,174 and the cases had been 296,275 for influenza and 48,328 for pneumonia. There is reason for thankfulness that this wild outbreak now appears to have burned itself out in some places and to have been brought under control in others, though it is to be feared that a large additional sacrifice will yet be recorded.

After so much has been done to protect humanity against epidemics the present outbreak seems at first thought most disheartening. Modern sanitation combined with health work of all kinds—public and private; preventive, protective and curative, and especially immunization—has gone so far in cutting down infectious diseases that a world-wide outbreak like the present one, which if continued for a year would more than decimate the population, is a great shock. This condition is largely due to the fact that until the present epidemic was well under way little had been attempted to prevent the spread of influenza, by controlling either the infected individual or the multitude which might be exposed to infection. In particular, no agent immunizing against influenza, like vaccine or antitoxin, has yet been generally adopted. Moreover, it is and probably ever will be harder to control airborne than food-borne infections.

Smallpox, typhoid fever, cholera, yellow fever, and the bubonic plague have been well-nigh eliminated among progressive peoples; diphtheria is almost in the same class, and so is malaria in many parts of the world; even tuberculosis is being cut down. These conquests are based on scientific research and the application of its teachings, combined with popular education, self-protection and a willingness to be controlled by health authorities.

Heretofore people have been slow to accept and act upon the simple fact that "colds," influenza and pneumonia are rapidly passed from person to person by air-borne germs. Consequently persons with severe "colds"—a symptom of air-borne diseases—have at all times mingled freely among other people without question or protest.

The present epidemic has brought a marked change which it is to be hoped is only a beginning of what may hereafter be expected in self-defence and for public protection. To begin with, influenza has been made a reportable disease. Some degree of isolation has been instituted. Nose and throat discharges are disinfected or burned. To reduce infection, widespread efforts have been made to lessen crowding on transportation routes and in places of public assembly. Office, factory and amusement hours have been rearranged to cut down the peak load of transit facilities. Schools, churches, theaters, libraries, saloons, have been closed. Window ventilation of cars and rooms has been required. In scattered instances gauze masks have been worn by civilians, and they have been ordered for general use in army camps. Immunization is being tried among industrial and business groups, in army camps and by individuals.

All the foregoing measures will mark an epoch in both public and private health-protective work.

Aside from the widespread reaction of these epidemics upon all industries, they have a direct interest to engineers in at least one respect—the reduction of peak loads on city transportation systems in order to reduce crowding and infection. Perhaps this reduction through rearrangement of opening and closing hours may yet become permanent.

This and related effects of the present epidemic illustrate anew how much that is normal and seemingly necessary in city life is abnormal to the individual and endangers the public health. Many of the problems of the engineer are due to these normal abnormalities and could be simplified with benefit to all concerned if public opinion were more enlightened and mankind less selfish.

The engineer has provided safe water-supplies to cities and removed the waters after their use and pollution; he has devised ways and means for the sanitary collection and disposal of garbage; he has made smooth streets for ease of use and cleansing; he has expanded cities laterally and skyward and provided speedy, safe and comfortable transportation in both directions; by means of heating, ventilating and cooling systems he has supplied ample quantities of clean air, warmed or cooled according to season, for the teeming population of city buildings. All these and other things he has done to meet the congestion resulting from city growth.

Some of the inevitable abnormalities of city living the engineer cannot ameliorate by mechanical creations or corrections, but he can point the way. Salvation rests with the people, individually and in mass. In the midst of an epidemic like the present the people must submit to drastic interferences with personal habits and liberties for their own and the common good. If they would do more of this at all times the tasks of the engineer would be easier, the health of the people would be better, and epidemics would rapidly diminish in frequency and severity.

Shipbuilding Methods of the "Eagle" Chaser Factory

Hull Erection Divided Among Seven Stations—Extensive Pre-Assembly—Rivets Heated by Electric Current—Launching Platform—Automatic Punching

[This article has been passed by the Chief Censor of the Navy Department]

BUILDING "Eagle" submarine chasers in the Ford factory on River Rouge is essentially a process of taking the ship to the material and men, as described in *Engineering News-Record* of Oct. 17, pages 698 to 702. This process, applied both in the hull erection and in the fitting out, involves skillfully planned detail methods and devices, essential to the success of high-speed "Eagle" building.

Primarily, the revolutionary shipbuilding methods are centered in the assembly shop. This shop represents the equivalent of 21 building berths and in addition the finished-material storage and the pre-assembly shop. It is the key feature of the River Rouge factory. All the hull-erection work is carried on under its roof.

FIG. 1. TIME SAVED IN HULL ERECTION OF "EAGLES" BY PRE-ASSEMBLY OF PARTS

The assembly shop is a steel-frame structure 300 x 1700 ft. in plan, with clearance height of 36 ft. 5 in., except that the ship-assembly bays have a clearance height of 50 ft. 9 in. for 400 ft. at the outgoing end. The plan diagram Fig. 2 indicates the relation of the structure to the shipbuilding operation. In spite of the great width of the building, excellent daylight is obtained throughout its area by ample glazing of sides and roof monitors.

Passing down the length of the building in three separate files, the hulls under construction occupy successively the seven stations indicated on the plan. Each file is separated from the next by a supply- and material-storage bay. All five bays are 51 ft. wide. A narrower lean-to along each side supplements the supply bays (Fig. 3). Bridge cranes span the assembly or working-line bays. Each line bay is served by four 5-ton cranes, one of which is situated in the high part at the outgoing end. There are no bridge cranes in the supply bays, but instead several hand-trolley jib cranes are bracketed to the columns near the incoming end of the building.

By this arrangement, space is provided alongside each hull-erection station for the material required at that station. Plates and other parts fabricated in the punch shop (at the right, a short distance from the incoming end of the assembly shop) move down the center of one of the supply bays on wheeled trucks running on a track the full length of the bay, and are unloaded directly at the station where required.

When the idea of erecting the hulls in a file of carriages moving along the railway track was conceived, the decision was also reached to use a standard-gage track for this ship support because standard railway

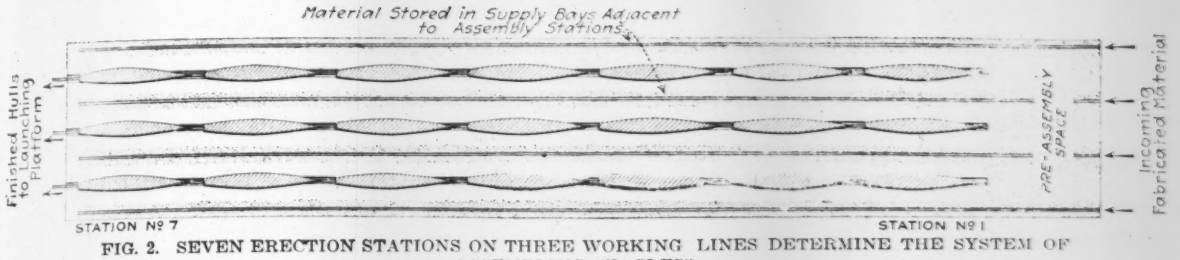

Material Stored in Supply Bays Adjacent to Assembly Stations
Finished Hulls to Launching Platform
PRE-ASSEMBLY SPACE
Incoming Fabricated Material
STATION Nº 7
STATION Nº 1

FIG. 2. SEVEN ERECTION STATIONS ON THREE WORKING LINES DETERMINE THE SYSTEM OF ASSEMBLING "EAGLES"

trucks could be used (with springs blocked). Though the wheelbase of 4 ft. 8½ in. is narrow in comparison with the size of the ship, no trouble from lack of stability has been experienced. As the hulls grow, shoring is set against the bottom or the sides, either for temporary support of parts or to hold the ship securely in place. Aside from their wheel support, the trucks are secured against tipping by outrigger shoes attached to the truck bolsters and extending down to within ¼ in. of the rail of a track of 10-ft. gage. This outer track is laid the full length of the working-line bays, on the transfer table and on the launching platform.

The successive carriages of the assembly file are not connected as they would be under a continuous-movement arrangement, but are moved individually when the file is shifted ahead one station. A sketch of the carriage construction, Fig. 4, shows the main or base support of the ship. The wedge keel-blocks in Fig. 7, a relatively late addition, provide for accurately level setting of the keel and any necessary readjustment. A hull carriage comprises 11 sections supported by 12 four-wheeled trucks, but at stations 6 and 7 the two rear sections are taken out and the stern of the ship is supported by shoring from the track and platforms, to give room for placing the shaft bracket and boring the tail-shaft bearings. The weight of the hull at the time of launching is about 250 tons, of which 200 tons are structural material.

Methods of Pre-Assembly of Hull Parts

Organizing the assembly process was a matter of gradually learning by trial how much time the individual operations consume and how they can be allocated most advantageously to the different stations so as to suit the requirements of hull construction. A prominent factor in this development was the evolution of pre-assembly of parts. The large pre-assembly space at the incoming end of the building now has all its skids fully occupied with parts being bolted and riveted up. Riveting is done wholly by air hammers, although a horizontal gap riveter is provided in one of the bays.

Pre-assembly of keel and keelson girder at station 1 constitutes a particularly interesting item of this preparatory work. It is done on horses immediately alongside the first station, as sketched in Fig. 5. When the file of hulls advances, and station 1 is vacated, a hull carriage is brought back from the launching platform (in separate truck sections) by the bridge cranes, and is placed and assembled with its sills and bolsters. Then the finished keel is swung across to position on the keel blocks, ready for the setting of frames.

Until recently, frames, bulkheads, deck sections and tanks were the principal items pre-assembled. As it became increasingly clear that pre-assembly was the key to rapid station work, the subject was taken in hand more boldly. Now the complete stem section, about four frames long, and the stern for a length of about eight frames, are built complete on the skids and set in place as units. A great amount of handling, fitting and bolting is saved, which cuts down the building time and reduces the concentration of men. Furthermore, much riveting is transferred from the stations to the skids. About 15% of the rivets in the ship are driven in the pre-assembly.

One of the special devices developed for facilitating pre-assembly is a frame-assembling gage, shown by the

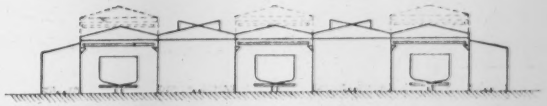


FIG. 3. HULL MATERIAL STORED IN SUPPLY BAYS BETWEEN WORKING-LINE BAYS

drawing in Fig. 7; it can be seen also in the view, Fig. 6. Here the separate floors, brackets and side members of a frame are set in proper position without any measuring or fitting, after the standards of the gage have been adjusted to the correct width of the frame in question by a right-and-left screw in the base. Bolting up and riveting are then carried out quickly and with no uncertainty as to whether the correct shape of frame is obtained. This jig was designed by Superintendent Whiting of the assembly shop.

Organization of the Hull Assembly

Before the various operations involved in the hull erection could be scheduled as to order, and the items allocated to specific stations, many preliminary difficulties had to be overcome. With a new kind of ship and a new shipbuilding procedure the methods of doing some parts of the work had to be developed by actual trial in the shop. Every change in method—and sometimes detail changes in the construction of the ship—influenced other parts of the work as to best order and convenience. The time required for the several elementary operations could not be determined exactly at the start, and therefore an accurate balancing of the several allotments of labor and time to the stations was necessarily a matter of successive approximation.

One kind of difficulty is illustrated by the schedule for station 1. Originally the plan was to complete the entire main frame of the ship here, in order to produce a relatively stiff and robust hull structure before the first move. The early schedules were altered when experience on one or two hulls in the shop showed that this plan of complete frame erection consumed too much

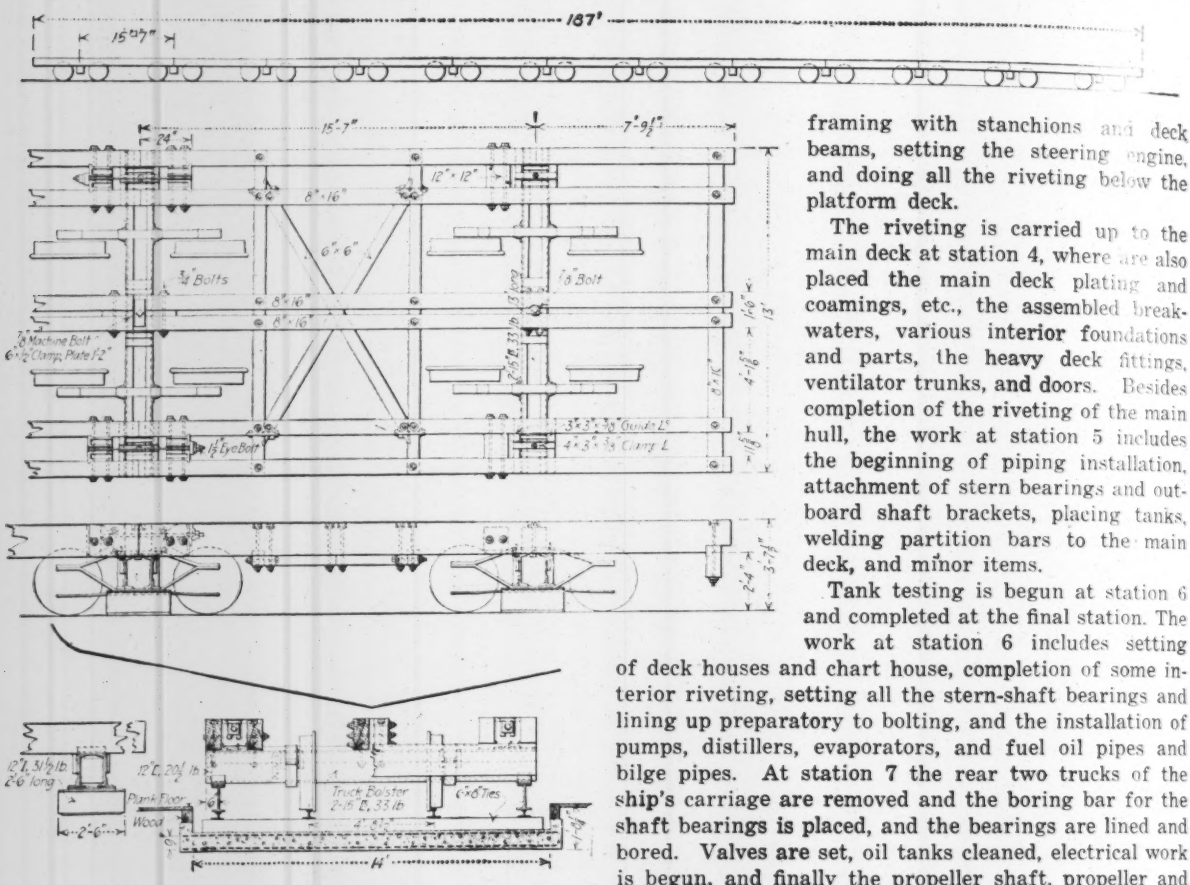


FIG. 4. SHIP BUILT ON CARRIAGE MADE OF RAILWAY TRUCKS IN A LONG FILE

time for one station. Further, it was found that moving the carriage ahead on its track did not disturb the position of the parts perceptibly, even when the framing was not complete.

In the form finally adopted the schedule of operations distributes the total work among the seven stations as nearly as possible in equal shares, except in so far as individual operations like that of boring the shaft bearings and subjecting the hull to hydrostatic test are locally governing factors to disturb the balance.

At station 1, after the truck is made ready for the hull, the assembled keel is slid over from the assembly horses, the keel plate at the after end of this section is set, and then in successive order are placed the two bottom strakes, floors and bulkheads of the after end, the forward athwartship bulkhead, the assembled frames of the main portion of the ship's length, and the lower strake of the sideplating. At station 2 the side keelsons and stringers are bolted up and the assembled boiler foundation and turbine foundation are placed; the bilge strake is set and a number of minor parts are added. Stanchions and platform deck beams are also set at this station.

Riveting begins at station 3 and continues throughout stations 4 and 5, being virtually completed before the ship goes to station 6. At station 3 the largest items of work are setting the unit-assembly bow section and the corresponding stern section, finishing the main framing with stanchions and deck beams, setting the steering engine, and doing all the riveting below the platform deck.

The riveting is carried up to the main deck at station 4, where are also placed the main deck plating and coamings, etc., the assembled breakwaters, various interior foundations and parts, the heavy deck fittings, ventilator trunks, and doors. Besides completion of the riveting of the main hull, the work at station 5 includes the beginning of piping installation, attachment of stern bearings and outboard shaft brackets, placing tanks, welding partition bars to the main deck, and minor items.

Tank testing is begun at station 6 and completed at the final station. The work at station 6 includes setting of deck houses and chart house, completion of some interior riveting, setting all the stern-shaft bearings and lining up preparatory to bolting, and the installation of pumps, distillers, evaporators, and fuel oil pipes and bilge pipes. At station 7 the rear two trucks of the ship's carriage are removed and the boring bar for the shaft bearings is placed, and the bearings are lined and bored. Valves are set, oil tanks cleaned, electrical work is begun, and finally the propeller shaft, propeller and rudder are set in place. The hull having in the meantime been cemented inside, the ship is ready to pass out of the assembly shop and go to the launching platform.

As soon as launched, and while on the way to the fitting-out dock, the ship is inspected in detail, and various minor operations are carried on to get the hull ready for the installation of machinery.

Hulls Checked up by Transit and Level

After experience in hull erection showed that complete assembly of the main framing at station 1 was not possible, it was discovered also that slight changes of position of the hull were likely to occur at all of the stations. A daily check-survey system was therefore established, in order to make sure of maintaining position and alignment. A survey corps checks up level and line of keel and verticality of frames and center line daily, making the rounds of the 21 hulls. Any misadjustment is at once corrected by the wedge keel-blocks and by shores.

Removal of the last two trucks of the carriage at station 7 results in a slight deflection of the stern portion of the ship which is important with respect to the subsequent setting of the turbine reduction gear. Care must be taken to see that the stern does not drop below its position when afloat and ready for the gear installation. The shaft bearings being bored at station 7, the adjustment of the ship to its buoyancy distribution after launching tends to raise the forward end of the shaft and bring the turbine gear foundation slightly

low. In this position of parts the gear is easily adjusted by shimming to correct alignment with the shaft, and all risk is avoided of having the shaft so low as to require cutting down the gear foundation in order to line up the machinery.

About 243,000 rivets, most of them ¾-in. and ⅞-in., are contained in the "Eagle," and of these more than 200,000 must be driven on the hull-erection carriages. For the ultimate rate of production of the plant—one ship a day—it will be necessary to drive more than 20,000 rivets daily at each of nine stations (stations 3 to

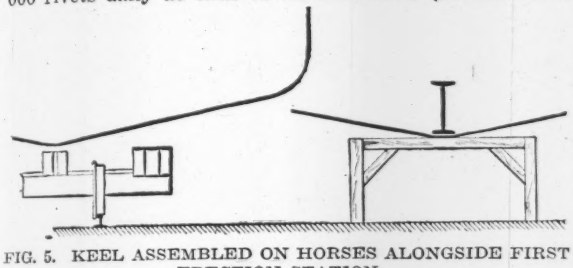


FIG. 5. KEEL ASSEMBLED ON HORSES ALONGSIDE FIRST ERECTION STATION

5 on three working lines). In view of the magnitude of this daily task, the rivet-handling methods are especially interesting.

By far the greater proportion of the rivets are countersunk, with a 60° angle of countersink and with point shaped to ¼-in. rise. This "mushroom" point gives greater strength than a flush point, and also makes the driving easier by the use of a slightly cupped rivet set in place of a flat one.

All rivets as received are cleaned of dirt and loose scale in two tumbling barrels set up in a rivet-handling inclosure near the center of each supply bay. From here they are distributed, in bright and clean condition, to their various stations. If used in the heaters in the condition as originally received, scaling would cause constant trouble in the heater.

Electric rivet heaters are among the remarkable innovations in the "Eagle" manufacture. They were designed by E. F. Allison, chief electrician of the Ford Motor Co. Such a heater comprises a simple transformer whose secondary circuit terminates in a jaw having upper and lower contact plates, the upper one spring-mounted, between which the rivet is placed in vertical position. The contact resistance of the large current flowing through the rivet produces the proper riveting heat in about 30 sec.—just time for taking the hot rivet to the ship and returning to the heater for the next. Heating is most rapid at the point, the head brightening up last.

A convenient riveting scaffold is another innovation. It consists of hook-ended hangers (Fig. 9) with laterally projecting bolts, and similarly hook-ended bracket members, which can be placed instantaneously. The hangers are hooked over the top of the shell; extension lengths can be hooked to their lower ends just as easily.

A sharp departure is made from the ordinary shipyard practice of countersinking the plates in the punch shop before they come to the ship. At the "Eagle" plant the countersinking is done on the ship, when the plates are in place. It is combined with the operation of reaming, through the use of a reamer shaped with a countersink taper in its rear portion; a stop on the tool assures correct depth of countersink. One advantage of this procedure is that perfectly true countersinks are obtained, whereas when the countersinking is done in the punch shop the subsequent reaming of holes not perfectly matching shifts the axis of the hole and results in forcing the head to one side of the shaft of the rivet. This gain in rivet quality, and the elimination of such errors as countersinking the wrong side of the plate (which may occur in the case of shop countersinking) are decisive advantages, although the hand countersinking proved to be rather heavy work in the 12-lb. shell plating.

Simplicity of the Hull Construction Work Largely Due to Design

With all frames straight, with no plates except those of the bilge strake requiring to be curved in bending-rolls, with only four furnace plates under the keel (one of these is die-forged in an outside plant and is received at the "Eagle" factory ready shaped), the manufacture is largely reduced to simple punching and assembly work arranged in the manner described. Furnace bending is practically limited to the shaping of the watertight boundary angles of the bulkheads. Only one set of bending-rolls is provided in the punch shop, which is

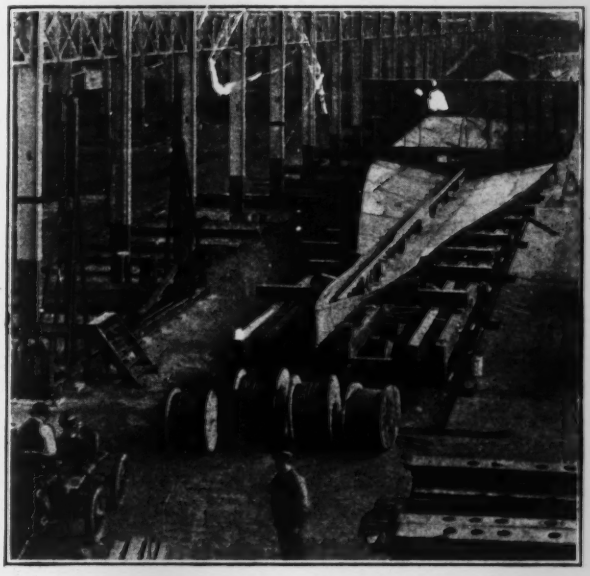


FIG. 6. SPECIAL GAGE FACILITATES RIVETING OF SHIP FRAMES

sufficient to take care of the bilge plate. Flanging the frame members and brackets is done cold by two large plate benders.

These elements of simplicity are to be credited to the Navy Department's original design, which, as already stated, was conceived with factory production in view. Notable elements of the design, besides those mentioned and those represented in the frame section, are the use of V-shaped keel plates, the avoidance of forgings and complex plating at stem and stern, straight-line longitudinal shaping so that both bottom and shell plates can be drawn into position directly from the flat, and elimination of joggling by using short, tapered liners, not only at butt-laps but also on the frames, under the out-plates of the shell, these plates being drawn in to

the frames. The boundary angles of water-tight and oil-tight bulkheads are stapled to fit the plating.

Unusually numerous lightening holes in floors, frames, brackets, etc., are called for by the design. They are produced very expeditiously, however, and do not make the shop work less simple. The smaller holes are stamped out while the larger ones are burned out with oxyacetylene flame. Flame welding is also used extensively, chiefly for the corners of bulkhead angles and similar work.

Plates ranging in weight from 6 to 12 lb. per square foot make up the structure of the ship. Stanchions are made of tubes pressed flat at the ends for riveting to angle clips at the floor and deck connections. Making the keel plate part of the shell plating eliminates the necessity for edge-planing as required in ships of ordinary design at the junction of keel and shell plate. A warped surface occurs in the rear portion of the ship's bottom; the shell plating here can be drawn down to the frames without difficulty, however.

When the designers in the Ford Motor Co.'s ship-drafting force carried out the detailing, and undertook to work out the plating for a maximum amount of multiple punching, they found a considerable gain in accuracy by laying out the plating on the drafting board by graphical projection to a scale of 3 in. to the foot. The results of this process checked against the mold-loft layout, proved to give superior accuracy and furnished a satisfactory basis for fixing the dimensions of plate and laying out the riveting.

In the search for further simplification of manufacture, electric welding of bulkheads, deck houses and other parts not calling for great structural strength is being introduced. The stimulus for the attempt came partly from the successful ship work done in England in electric butt-welding. Recently a complete athwartship bulkhead was made up by welding, and steps were taken to systematize the work for regular application.

"Quasi-arc" welding is used. The joints of the plating are butt-welded, while the boundary and stiffener angles are attached by edge welding and intermediate welding, as sketched. The first intermediate welding tried was like that used in the English experiments, the angle leg in contact with the plate being notched, so as to bring part of the welded toe edge close to the position of the ordinary rivet line. As an improvement on this, elongated holes were punched in the angles, and the edge of the angle along the inside of this hole was welded to the plate.

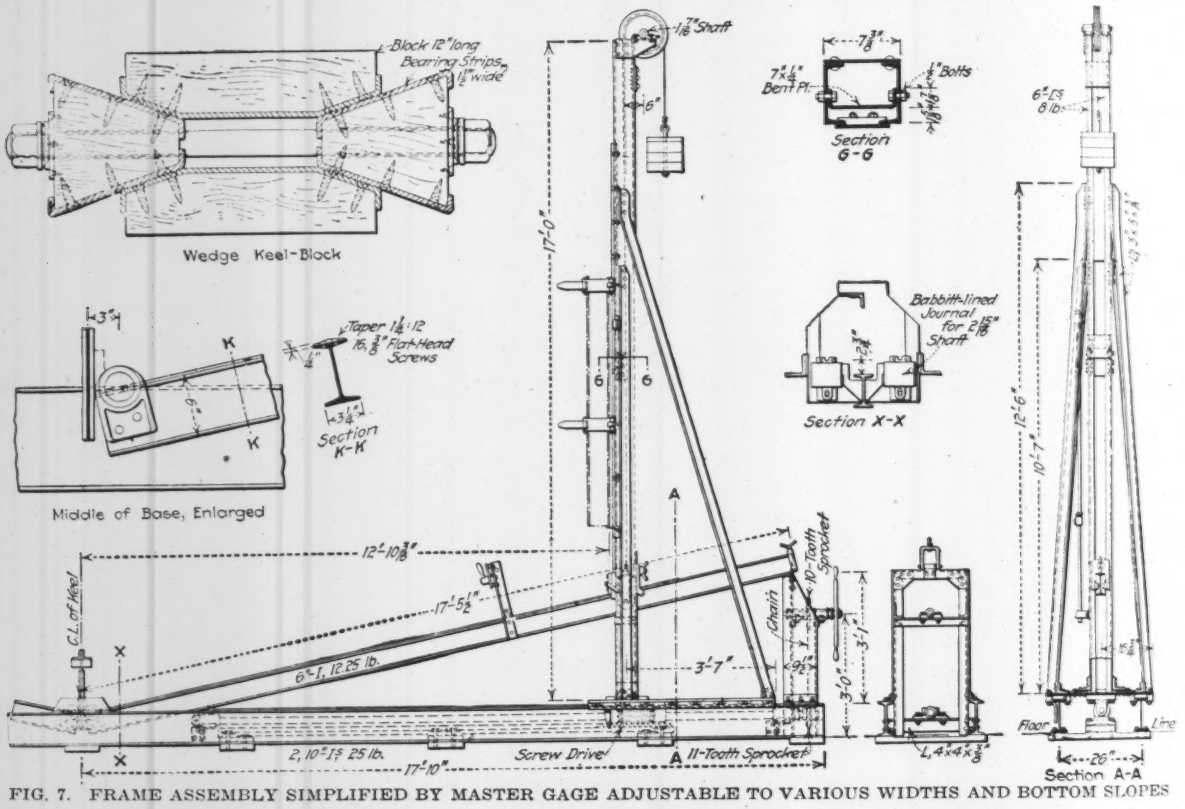


FIG. 7. FRAME ASSEMBLY SIMPLIFIED BY MASTER GAGE ADJUSTABLE TO VARIOUS WIDTHS AND BOTTOM SLOPES

From the last station of the assembly shop, the completed hull passes out through one of three large steel rolling doors in the end of the building—the largest steel curtains ever used—and, still mounted on its carriage, moves forward for transfer to the launching platform.

This operation is accomplished by a transfer table, which, except for its length, 200 ft., is precisely like those used in locomotive shops. It runs on 11 rails transverse to the axis of the plant, and is carried by two wheels per rail, one of the two being driven from a longitudinal shaft connected to an electric motor at mid-length. The deck carries four rails, two for the hull carriages and two for the outriggers or steadying plates of the carriage. Forward of the transfer table, at its right end, is the launching platform, to which the ship is moved over a short length of approach track.

less in the politician as a business administrator. He feels keenly that the Government is now operating the railroads not because the owners were given a fair chance and failed, but because unintelligent regulation denied them that chance.

This man thinks the line of advancement prevalent on the Pennsylvania system affords opportunity for sufficient acquaintance with the problems of operation before promotion to the superintendency. He believes there is some opportunity for improvement in engineering education, and thinks well of the coöperative system at the University of Cincinnati; and yet he doubts whether it is feasible to teach understanding of men at the student age. To use his expression, "You must look out that your layer cake does not turn out to be simply hash." Rather, he favors a broad university course, as contrasted with the technical school course, and afterward, for the would-be railroad official, short periods in a number of different railroad departments.

The Right Man Plus Engineering Training

On the other side of the railroad fence from this president is another engineer—the Federal manager before mentioned—another man of striking personality, whose rise has been rapid. This man has no illusions about engineers. To him it is the man himself who counts for most, and while he decries the prejudice against engineers that once existed on his road, he will not promote a man merely because he is an engineer. But withal he has a deep faith in the value of the college training, and especially the engineering training, as a groundwork for the solving of transportation problems. "When the technical man has a new operating problem to solve," said he, "he sets to work to analyze it and work it through; the man without the education probably will look back in his experience for a similar problem solved, and if he finds no guiding precedent he is in trouble." This executive tries to give his nontechnical operating officials something of the engineering viewpoint by sending to them young engineers with charts and diagrams; the officials, he finds, readily ask the engineers to explain them and show their uses.

This man has well formulated views as to the defects in engineering education, and they accord to a striking degree with Dr. Mann's, though expressed to the writer before the Mann report was published. He believes that the schools should give more care to developing the human side of engineering; that there should be more effective testing and grading of students, and the weeding out of poor prospects. He also believes that far more thought should be given to character study in the building up of the railroad personnel.

Does Engineering Narrow One?

Two engineers who have remained in their engineering departments, although they have evinced much interest in operating matters, were asked their views. One of them, a member of an engineering department that, perhaps because of its size and dignity, has remained more than ordinarily aloof from the transportation department, is a firm believer in the value of the engineering training. He regretted that he had perceived a lack of understanding of operating problems among many of his associates. This opinion was independently concurred in by an operating official—not an engineer—of the same road; and the moral seems to be that every railroad engineer, if he aspires to a high office on his road, must remember that the chief purpose of the railroad is not to build bridges or yards, but to move traffic. The other engineer, connected with a road on which there is a less sharp line of cleavage, thought that environment and attitude governed, and that the young engineer, put where he could learn the purposes of the railroad and encouraged to study them, had an excellent chance to become a successful operating man.

Efforts of the writer to get the views of executives who were not engineers by training were not wholly successful. Several who were approached thought they could contribute nothing to the discussion. Such comment as was elicited was in the main favorable to the engineer. The operating official mentioned in the preceding paragraph, while cognizant of deficiency in some of the engineers he had encountered, thought the fault was mainly in the men, and believed the engineering training ought to be a great help to the operating man. More significant, however, was the brief and crisp statement of one of the most eminent railroad presidents —that, though not an engineer himself, he had chosen an engineer for his chief assistant. And the impression was conveyed that this assistant was not merely a highly capable man who happened to have studied and practiced engineering in his earlier days, but a man whose engineering viewpoint dominated his actions and was a most important fact in his success.

Conclusion

The views of these eight men, who are believed to be fairly representative of successful railroad men, show striking similarity, though they of course bear the impress of the personalities of the men who gave them. In part they are corroborated by opinions of still other railroad men not recorded here. There is general agreement that the engineering training and viewpoint afford an excellent foundation for success in solving the broader railroad problems, and the men highest up seem most aware of the value of such a foundation. In his report on engineering education Dr. Mann says the ultimate aim of engineering education is more intelligent production. *Engineering News-Record* concurs fully in this belief, and in his belief that engineering schools have not recognized this as they should. If individual engineers have failed as producers of transportation the writer ventures the opinion that this proves, not that engineering training tends to disqualify men for the larger railroad work, but merely that these individuals were not, according to the modern definition, good engineers. It is for the profession to realize and prove—with the help of the engineering schools—that *railroad operation* IS *engineering.*

Sioux City Has City Plan Commission

A city planning ordinance was passed recently at Sioux City, Iowa, and a commission of 21 members is being organized. A general review of the situation will be made, but there is no expectation of projects being carried out under the supervision of the commission for some time to come.

U. S. Engineers Bridge Marne With German Equipment

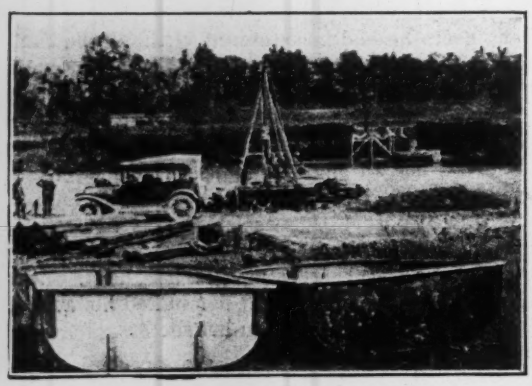
In Van of Advance, Engineers Build Floating and Trestle Structures for Hurried Allied Crossing

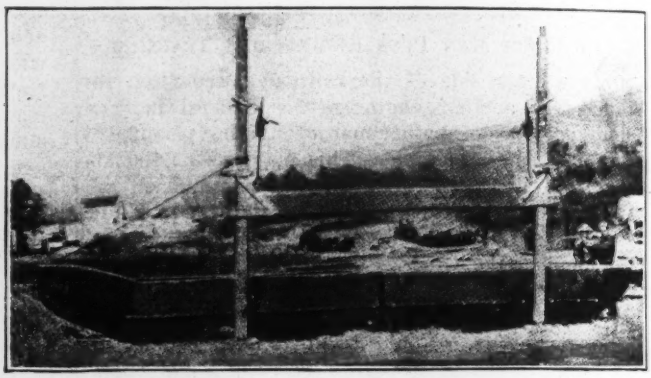
By Robert K. Tomlin, Jr.

WORKING under shell fire and using German ponton equipment captured during the recent Allied advance in the region of the Marne, companies of the —th United States Engineers successfully spanned the historic French river, thereby opening up lines of communication which made possible a substantial drive into enemy territory. This achievement is the first of its kind to be recorded in the annals of the American Expeditionary Forces, and is of particular significance in showing the change in the type of work demanded of engineer troops at the front, following the transition from trench warfare to a war of movement. The following notes are based upon reports submitted to the chief engineer, American Expeditionary Forces, by the commanding officer of the —th Engineers:

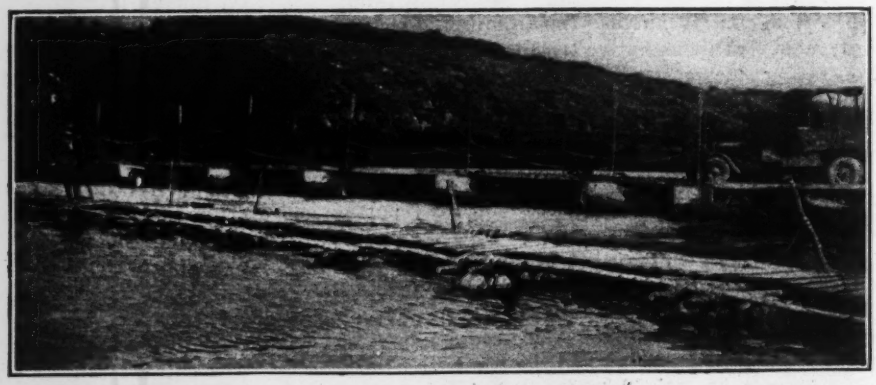
Immediately prior to the time when the call came for the crossing of the Marne, all companies of the regiment had been engaged principally on fortification work in a certain divisional area. The construction of fire trenches, wire entanglements, regimental and battalion P.C.'s, dressing stations, signal stations, and the strengthening of farmhouse cellars to resist artillery fire, served as the prelude to the new work of bridge building later accomplished.

It was on the morning of July 15, after a heavy bombardment, that the Germans launched their attack





PILEDRIVER, PONTON SECTIONS AND TRESTLE BENT CAPTURED FROM THE GERMANS



PONTON BRIDGE BUILT WITH GERMAN EQUIPMENT AFTER CROSSING HAD BEEN MADE BY FOOT-BRIDGE SUPPORTED ON CASKS

TRESTLE BRIDGE FOR HEAVY TRAFFIC WAS BUILT TO RELIEVE PONTON STRUCTURE

on this particular divisional front. Although not in direct contact with the enemy at this time, the companies of the —th Engineers, then in various wooded areas back of the front, were not spared by the enemy's artillery fire. In the forward movement which ensued, one company on July 19 advanced with an infantry regiment, and was successful in seizing and salvaging a quantity of German ponton equipment along the north bank of the Marne.

Two days later other companies of the engineers moved up to join the first, and during the night of July 21-22 foot-bridges were built. On July 22 the members of the regiment had the satisfaction of launching the enemy's equipment and completing the ponton structure across the Marne.

Speedy Work on Heavy Trestle Bridge to Replace Ponton Structure

But the work did not stop at this stage. The arrival of two additional companies July 23 was the signal for the beginning of work on a heavy trestle bridge to relieve the traffic which the finished ponton bridge was carrying. Speedy work was done on the trestle bridge construction, for at noon on the day after the two companies arrived at the site vehicles were moving northward across it. With the completion of the trestle bridge, the ponton structure was removed, under cover of night, and reconstructed at a new site where a crossing was urgently needed.

Shifting to new territory, another company of the regiment a few days later reached the River Ourcq, where the enemy, in his retreat, had demolished a crossing. This bridge was speedily rebuilt and placed in service, but an attempt to span the same stream at a second point had to be abandoned because of the intensity of the German artillery fire.

At the end of the month, all but one of the engineer companies were relieved. The unit remaining continued the construction of another trestle bridge and busied itself with the collection of enemy ponton equipment in the neighborhood. About 80 German boats of the types shown in the accompanying pictures were finally obtained.

Spans Exceed 200 Feet

Both of the foot-bridges referred to were hastily constructed by the use of *bidons*, or casks, rigged as floats. In each case the span was about 230 ft. The heavier trestle bridge over the Marne, with a span of 215 ft., was built of any material that could be quickly obtained near at hand. Into this structure went a number of telegraph poles and a quantity of 3 x 9-in. planks which happened to be at a near-by dump.

The accompanying photographs indicate the types of bridge structure employed and show the details of the captured German pontons, which are now serving to transport the men and material of the allied forces across the Marne. An inventory of the bridging material abandoned by the enemy in the divisional area where United States engineer troops were operating shows the following: Enough pontons and ponton equipage for about 30 bays of span, 6 ponton wagons in fair condition, 2 piledrivers, a large quantity of bridge timber and other miscellaneous bridging equipment.

Length of Motor-Truck Stop Varies Inversely as Braked Load

Tests Show That Shortest Stops Are Made By Trucks Having Large Percentage of Load On Rear Wheels

BRAKING tests of motor trucks and automobiles which have been made in Chicago show the advantage of concentrating a large proportion of the load on the braked wheels, which are the rear or driving wheels. Maximum braking effect, it is known, may be obtained by so controlling the brakes as merely to retard the revolution of the wheels. If the wheels are stopped or locked they will slide on the paving, and the resistance due to sliding may be considerably less than that due to braking. In tests made by the engineers of the Nash Motors Co., however, it was assumed that in an emergency most drivers would apply the brakes so hard as to lock the wheels, and the distance was measured from the point where the wheels began to slip to the point of stoppage.

In regard to sliding, it is stated by G. W. Smith, assistant chief engineer, that the coefficient of friction of rubber tires on dry paving is taken usually as 0.6 to 0.7. The tests were made on a concrete road having a thin coating of oily dust, and the coefficient was found to be only 0.475 to 0.530. It is thought probable that an average of 0.5 would apply to all the vehicles in the test, whatever their weight. Mr. Smith explains that the point it was desired to bring out was that the ability to retard a vehicle depends upon the proportion of the total weight of the vehicle which is imposed upon the the tires subject to braking action. Thus, a vehicle having 65% of its total weight on the rear or brake wheels would make a stop proportionately quicker than one made by a vehicle in which this load was only 50 per cent.

With a uniform speed of 20 miles per hour the shortest stops were made by trucks having a relatively high percentage of total weight carried by the rear or braked wheels, while the longest stops were made by a touring car with relatively light rear wheel loading. The results are shown in Table I.

TABLE I. STOPPING TESTS ON MOTOR VEHICLES BY NASH MOTORS COMPANY—SPEED 20 MILES PER HOUR

Vehicle	Paying Load, Lb.	Total Weight, Lb.	Weight on Rear Axle, Lb.	Weight on Front Axle, Lb.	Braked Load, %	Average Length of Stop, Ft.
1-ton truck	1,500	4,740	3,060	1,680	65 0	39 0
1-ton truck	4,000	7,348	5,740	1,608	78.7	36 2
Touring car	.....	3,085	1,575	1,510	51 0	53 7

Another set of tests was made by L. D. Hemman, superintendent of delivery for "The Fair" department store. Owing to differences in methods of observation it may be noted that the results are not directly comparable with those of the first set, as the percentage of braked weight is not given. The results, however, are shown in Table II. Solid rubber tires were used on all the trucks as follows: 36 x 5-in. dual tires for the 3-ton truck, 36 x 4-in. dual tires for the 2-ton trucks, and 36 x 3-in. single tires for the ½-ton truck. The touring car had 37 x 5-in. pneumatic tires. Mr. Hemman states that these last were inflated to a low pressure, which allowed them to flatten somewhat and thus

give a greater traction surface than if inflated to their full capacity, which, it may be pointed out, would explain the short stop made by this vehicle on the dry pavement.

Skidding of light trucks on wet pavement when the brakes were applied took place in Mr. Hemman's tests, which were made on asphalt paving and with a uniform

TABLE II. STOPPING TESTS ON MOTOR VEHICLES BY L. D. HEMMAN—SPEED 15 MILES PER HOUR

Vehicle	Dry Asphalt—Total Weight, Lb.	Dry Asphalt—Length of Stop, Ft.	Wet Asphalt—Total Weight, Lb.	Wet Asphalt—Length of Stop, Ft.
½-ton truck	4,700	23	4,700	61
2-ton truck	8,500	19	8,850	52
2-ton truck	....	..	9,000	55
3-ton truck	....	..	10,000	48
Touring car	4,600	19½	4,600	73

speed of 15 miles per hour. When the streets were very wet, with a slight coating of sloppy snow, the skidding tendency of the lighter machines was increased so greatly that it was found almost impossible to keep them from turning round completely while stopping. In spite of all care they skidded from the middle of the street to the curb, while the larger trucks would skid only 2 or 3 ft. out of line.

Records of these tests have appeared in publications of the Motor Truck Owners' Association, Chicago, and have been furnished by F. E. Ertsman, executive secretary.

Study Economics of Bridge Repair and Replacement, Urges C. A. Morse

WAR conditions affecting labor, material and the money market make it especially desirable to avoid reconstruction of bridges at this time, according to the views expressed at the annual meeting of the American Railway Bridge and Building Association by C. A. Morse, director of maintenance in the operating division of the United States Railroad Administration, and formerly chief engineer of the Rock Island lines. The following is an abstract of that part of the paper relating to bridge work:

It is possible to extend the life of pile and timber bridges indefinitely by replacing annually the separate parts of the structure. This being the case, it is desirable, under present conditions, to keep these structures in use by such partial renewals, although in ordinary times it is considered wise to renew a structure completely when a certain stage or life is reached.

Large quantities of treated timber, especially creosoted timber, have been used for repair work in recent years, but now it is impossible to get sufficient creosote to fill requirements. On the other hand, to renew bridges entirely with untreated material would result in comparatively short-lived structures. But in making repairs to extend the life by from one to five years untreated material should be used, as it will give the necessary service and is much easier to obtain than treated material.

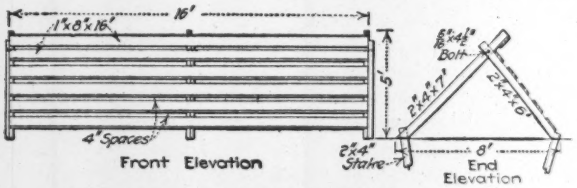
A few years ago railways could borrow money for additions and betterments at 4%, so that it was not economical to spend more than 4% of the cost of renewal in repairs that would extend the life of a structure by one year. And as labor and material cost much less at that time, it did not pay to make very extensive repairs. Now, however, this money costs from 7 to 10%, while labor and material—if they can be had—cost from 50 to 200% more than a few years ago. Therefore, we are warranted in making large expenditures for repairs at this time, especially for repairs that will extend the life of the structure until after the war, when renewals can be made at probably 25% and possibly 50% less cost than at the present time.

Careful inspection and study of each structure should be made. If it can be repaired so as to make it good for, say, four years, for 40 or 50% of what it would cost to renew or replace it, then the repairs should be made if they will extend the life one year for 7%, two years for 8% per year, or three years for 9% per year on the cost of renewal. If this policy is carried out we shall be able to get through 1919 with few, if any, full renewals of pile and trestle bridges, while there will be a great saving in both labor and material.

Steel structures should receive the same careful inspection and study. In the first place, they should be kept well painted, as nothing else gives added life to steel bridges at so little cost. Many structures that are somewhat light can be taken care of by strengthening those on important main lines or by reducing speed of trains on less important lines.

Sand and Snow Fence Protection on Colorado Roads

Four cuts on a state primary road in Colorado over a high divide between Fort Collins and Loveland have in past years blown full of snow several times during the winter. This stretch is through dry sandy land with



SNOW FENCE PROTECTS CUTS ON HIGHWAY

little vegetation to obstruct a full sweep of the wind. This year the road was protected by portable snow fences of the design shown in the accompanying cut.

During one recent winter traffic was stopped five or six times for several days. In fact the road could hardly be opened before another wind again filled the cuts level full. As the cost ran up to several hundred dollars the officials decided to install 77 16-ft. panels to protect all four cuts. The cost per panel amounted to $3.62, including construction and placing. The work was done under the direction of James G. Edwards.

Toronto Has Housing Problem

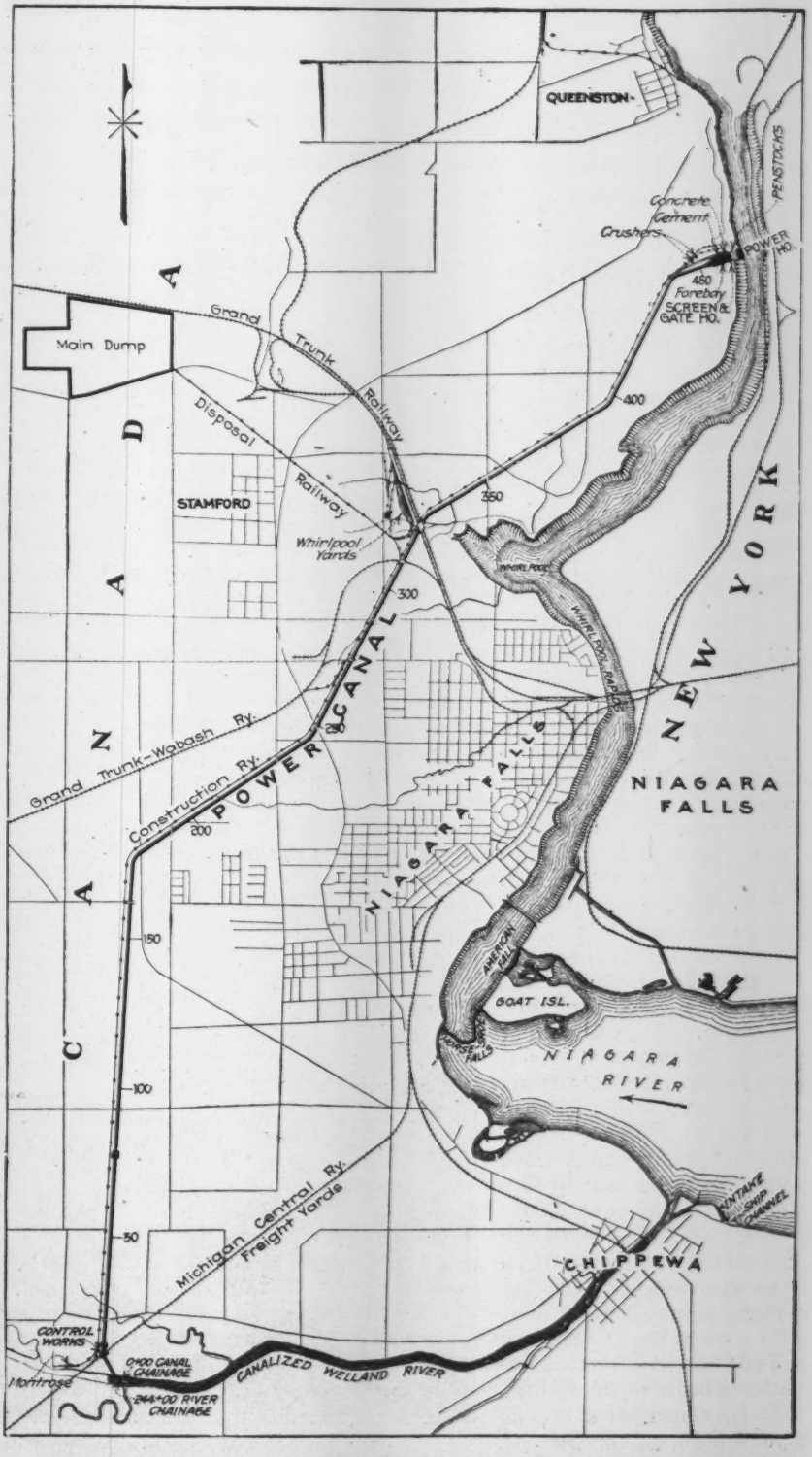
More than 5000 families in Toronto are in need of "sanitary dwellings that cannot be had, owing to the shortage," says Dr. Thomas J. Hastings, local medical officer of health, and president of the American Medical Health Association, in the monthly bulletin of the Toronto Board of Health. He also estimates that 5000 new houses will be needed yearly after the war. The board has requested Dr. Hastings to make a more extended report on the subject.

Canada Rushing Huge Niagara Development As War Conservation Measure

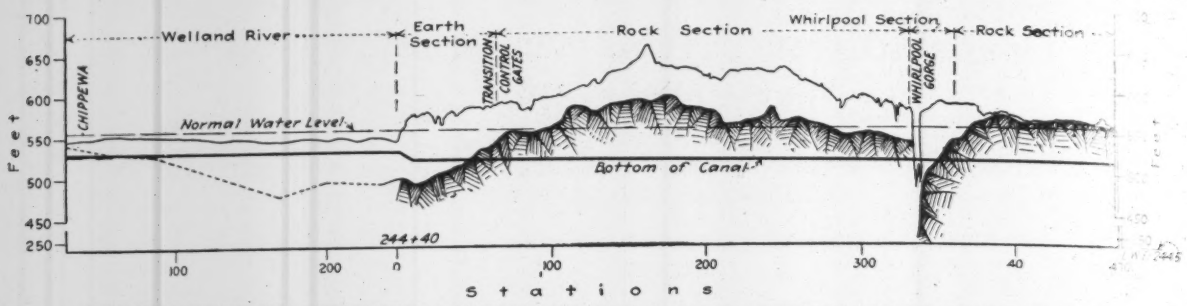
World's Largest Electric Shovels Digging 8½-Mile Canal Around Falls and Rapids to 300,000-Horsepower Power House in Heavy Overburden and Rock—Development to Cost $25,000,000

DIGGING partly in fine, wet clay sand, productive of dangerous slides when undrained, and partly in very stable red clay, the two largest electric revolving shovels in the world are stripping the site of the Queenston-Chippewa Canal, most of the flow section of which will be in rock. The canal, which will take water from the Niagara River above the Falls through the Welland River, locally known as Chippewa Creek, and deliver it to a 300,000-hp. power plant below the last rapids, is part of a project to develop 305 ft. net head of the 327-ft. difference in level between Lakes Erie and Ontario. The work is being pushed during the war by the Hydro-Electric Power Commission of Ontario as a conservation measure, made urgent by the great shortage of power, both steam and electric, in the territory served by power from Niagara Falls, and by the fact that none of the plants now in operation at the falls can be made to develop more than two-thirds of the total available head, while the treaty limit of possible diversion from the falls has been nearly reached, making it necessary to utilize the small surplus of available water under the maximum head which physical conditions will permit.

The construction, which is being carried on by forces of the commission, involves the removal, from the Welland River and the artificial section of the canal, of 13,000,000 yd. of earth, which is being taken out by cableway and dredge on the river section and by the big shovels in the dry cut, and 4,000,000 yd. of rock from the canal and forebay, to be removed by the big shovels and by standard railroad shovels. In addition to the power house and the gatehouse, ten concrete arch bridges, three of them carrying railroads, and a reinforced-concrete intake structure requiring extensive coffer-



CANAL FROM WELLAND RIVER TO NIAGARA GORGE BELOW RAPIDS



PROFILE SHOWING DIFFERENT SECTIONS OF CANAL, AND MATERIALS ENCOUNTERED IN EACH

dam work in the Niagara River, are among the structures required.

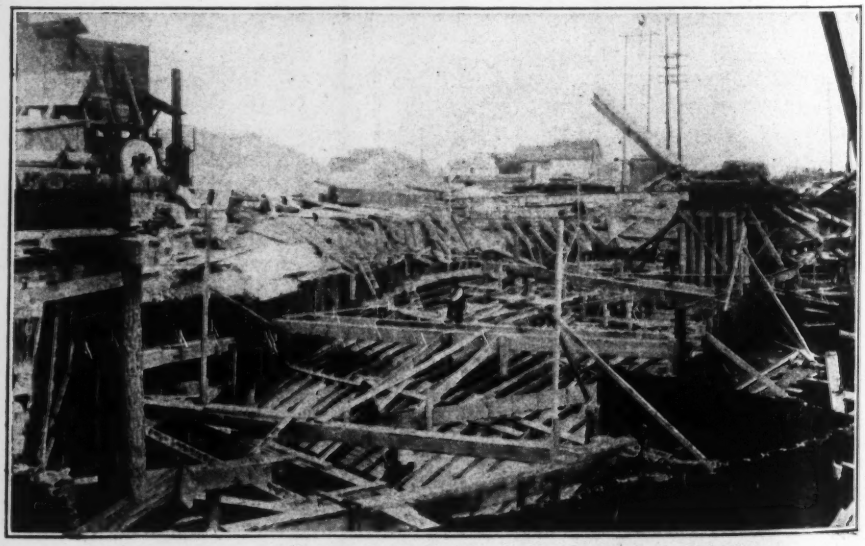
The dredged river channel, with a gradient of 0.63 ft. to the mile and a mean velocity of 2.0 ft. per second, and the canal, with a gradient of 1.1 ft. to the mile and an estimated velocity of 6 to 7 ft. per second, will pass 10,000 sec.-ft. of water. The power house will contain six 52,500-hp. units, and the site itself, as well as the scheme as a whole, is capable of being expanded, by the provision of additional waterways and power-house space, to take the entire quantity of water that can be diverted under the present treaty on the Canadian side, amounting to slightly more than 1,000,000 hp. capacity.

Drawing water from Grass Island pool after a slight fall from Lake Erie, and delivering it back into the Niagara River below the last rapids at a point where the fall to Lake Ontario is but little more than a foot, the general scheme of development is thought to be by far the most favorable of any yet conceived, and will cost, complete, about $25,000,000. The time of completion is conditioned by the excavation, on account of the heavy yardage involved, and the opening up of the work and the method of attack with large shovels was dictated by the character of the overburden, which could not be depended upon to support heavy, concentrated loads. The nature of the soil, which contains a considerable quantity of ground water and is so fine in places as to have the appearance of clay, made the use of large draglines, operating from the tops of the slopes, out of the question. For the same reason it was desirable to carry the heavy excavating equipment right through on the rock surface, to avoid the continuous trouble with soft ground. This required shovels with a great reach, cars on a track 64 ft. above the rock surface having to be loaded at several points. Very large revolving shovels were therefore selected for the work. One has a 90-ft. boom set at 53 deg., with a 58-ft. dipper stick and a 5-yd. dipper. Another has an 80-ft boom set at 45 deg., a 54-ft. dipper stick and an 8-yd. dipper. A third shovel, similar to the second, will soon be installed. After the earth is stripped and the three shovels are put on the rock excavation, all will be equipped with 5-yd. dippers.

The cut is made by starting a pilot near one side of the canal prism with a railroad shovel, loading cars on the ground surface. In this cut are run the loading tracks for the big shovel, which follows the pilot cut on the rock surface. The loading tracks connect with the main line at both ends, giving the shovels run-around service. With 20-yd. air-dump cars in eight- and ten-car trains, the big shovels have been able to load 4000 yd. in an eight-hour day.

The entire line of the canal is to be paralleled by a double-track standard-gage electric trolley railroad 175 ft. west of its center line. Near the middle of the work is a Y from which a double-track railroad runs two miles to the main dump, which is capable of taking 20,000,000 yd. The hauling equipment consists of one hundred and fifty 20-yd. air-dump cars, twelve 600-volt direct-current 50-ton electric locomotives, and seven steam locomotives. The maximum grade on the construction railroad, which, when complete, will contain 40 miles of single track, is 1%, and the haulage equipment is capable of making 10 miles loaded and 20 miles light with 10-car trains at any point on the line.

The trolley wires are offset 7 ft. from the center line of the tracks to permit the loading of dump cars, and in order to pass locomotive cranes, of which there are three 40-ton and two 15-ton machines on the work.

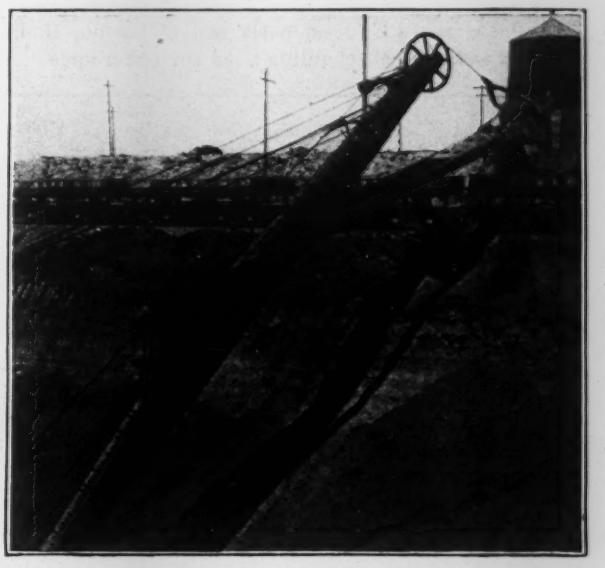


THE BRIDGES WERE BELOW THE ORIGINAL GROUND SURFACE

The order in which the work was opened up was dictated both by the length of time required for the excavation and by the location of three existing railroad crossings. Two of these are close together, as may be seen from the map, a short distance south of the Whirlpool Gulch, a deep cut which it is believed was once the bed of the Niagara River. Just south of this gulch occurs the heaviest earth cut on the canal, a face of 100 ft. being encountered here for a short distance. The shovel that started in at the south face of this gulch is the one with the 5-yd. dipper rigged to load cars on tracks 64 ft. above grade. It was possible to dispose of the excavation from this shovel to the extent of 1,500,000 yd. in the Whirlpool Gulch itself, making it unnecessary to cross a main-line railroad in order to get to the central dump. Since the short section between the Grand Trunk Ry. crossing and the next crossing south was the location for the Y leading off to the main dump, and since it could therefore be excavated before the railroad crossings were constructed, this point was selected for starting the other large shovel. With the excavation begun in this way, both shovels could be kept busy while the first bridge was being built. The construction railroad will pass under these railroad bridges, and sufficient clearance is provided for the large shovels by taking down the booms. The southerly shovel will be let out in this way and will proceed south, following the construction railroad and the pilot cut for the loading tracks, until the overburden is completely stripped; being helped, in all probability, by the third shovel when it arrives. The loading tracks will then be lowered to the rock surface, a pilot cut will be made by the railroad shovels, as in the earth section, and the shovel now operating at the Whirlpool Gulch will follow through, taking out the rock cut to grade. The other shovels will, on the completion of the earth excavation, turn north to meet it.

North of the Whirlpool Gulch the cut is almost entirely in rock, and there is a large forebay approximately 300 by 1000 ft. to be excavated. This rock will be removed by the railroad shovels, of which there are two of 3½-yd. and one of 2½-yd. capacity. There are also two ¾-yd. caterpillar revolving shovels on the work.

The forebay excavation was begun when the two large shovels were started, in order to provide rock for track ballast and for concreting. As the heavy end of the rock excavation is near the forebay, and as little stripping had to be done, the main crusher plant was located here. The rock, which is Niagara limestone, will be used as aggregate for all the concrete. A concrete plant located at the lip of the gorge above the power house will be able to concrete the head house and power house by gravity. As these structures will not take more than 18 months to build, it has not been necessary to start them as yet, and no work beyond the clearing of the building site has been undertaken at this point.



ONE OF THE SHOVELS WAS RIGGED TO LOAD CARS ON TRACKS 64 FEET ABOVE GRADE

The remaining portion of the work, the dredging of the Welland River, is being carried on simultaneously by a 3-yd. dipper dredge and a large cableway operating a clamshell bucket. On account of bridges, houses and rough ground the cableway was not able to start within 4400 ft. of the intake, and the work between that point and the Niagara River will be done by the dredge, the material being scowed into the Niagara River. The cableway has an 80-ft. head tower and a 60-ft. tail tower, both traveling on railroad trucks on parallel double tracks. The span is 800 ft., and the rig handles a 3-yd. clam. The head tower on the north bank of the river is set far enough back so that all the excavated material can be disposed of by dumping it on that bank. The total cut in the Welland River is to a depth of 30 ft. below the surface, but at 24 ft. below the surface a limited deposit of quicksand has been struck, which cannot be dug with any type of grab bucket yet tried on the cableway. It will prob-

ably be necessary to remove this quicksand with a dipper dredge.

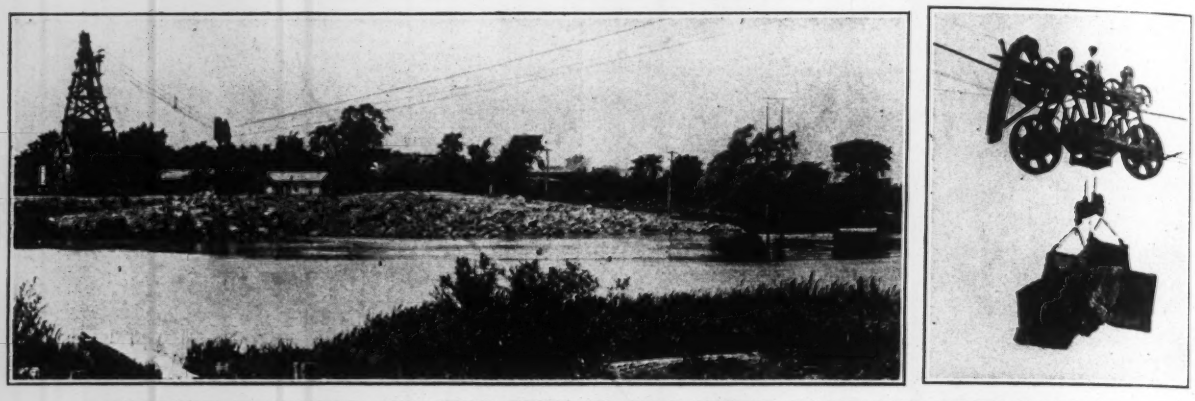
As might be expected, the early construction of the railroad bridges is essential to the prosecution of the excavation. The first started is the center one, as shown on the drawing. This bridge will let the southern shovel out, and by the time it is finished there will still be sufficient time to construct the Grand Trunk crossing before the second shovel will be ready to come through with the rock cut.

To build these bridges, holes had to be dug in the ground, and steel sheet piling used for cofferdams. As shown in one of the photographs, the crown of the arch in the first bridge built is below the ground surface. This bridge is for an electric railway road from Niagara Falls to St. Catharines, but the loading specified by the electric railway company was as heavy as that for either of the steam railroad bridges.

The railroad bridges each contain about 3500 yd. of concrete, each being a single arch. This excludes the wing walls, which will not be placed until the canal excavation has been completed. Because the bridges are built below the original ground surface, the concreting proved easy. It was only necessary to set up a mixer with a loading hopper on the edge of the excavation and spout the concrete directly to place in the forms. The mixer at the first of these bridges was served by a locomotive crane, material being received on a spur from the Grand Trunk Ry. The excavation was carried out with two derricks, the material being dumped around the cofferdam.

As will be seen from the profile, the first rock excavation available was at the lower end. The forebay excavation was begun by shooting out a 10-ft. lift over the entire area, about 1100 holes being fired at once. About one pound of dynamite to the yard, including that used for springing the holes, was used. Each hole was sprung with five or six sticks and loaded with 15 or 20 sticks, the spacing being 7 ft. each way. Several experiments with blasting caps wired up in various ways were tried in an adjacent open field, to make sure that the loaded holes would be fired simultaneously. The firing was done with a high-amperage but low-voltage current thrown with a single switch. As a result of this blast, about 60,000 yd. was broken fine enough to be handled by the railroad shovels.

The crusher plant near the forebay receives material by rail in the 20-yd. dump cars. These disch[illegible] direct into a large hopper lined with 2½ x 6-in. stee[illegible]s laid flat, and feed a 60 x 84-in. jaw crusher op[illegible]ed by a 250-hp. motor. This crusher reduces the [illegible]ne to 8-in. size and delivers it to a belt which tak[illegible] it to the top of the secondary crusher house, wh[illegible] it is fed into three gyratory crushers that reduce it to 2-in. size. From these crushers the material passes through a screen which removes dust and oversize aggregate, and is then carried on a suspended belt conveyor over the storage pile. At the end of the storage pile is the bin structure for the receipt of 1-in. stone to be used for reinforced-concrete work. The 1-in. material is obtained by bypassing the oversize aggregate, after it leaves the screen, into a small auxiliary gyratory crusher, which delivers its product directly into the bin mentioned above.

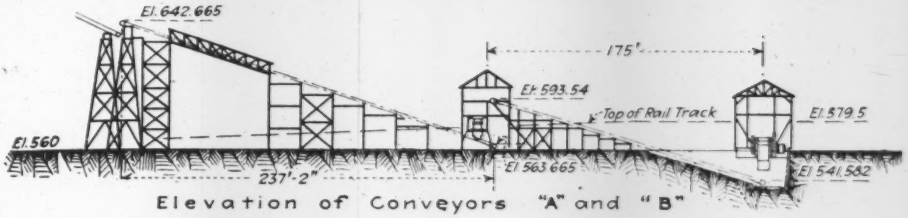


CABLEWAY EXCAVATOR AND NEAR VIEW OF GRAB BUCKET ON WELLAND RIVER SECTION

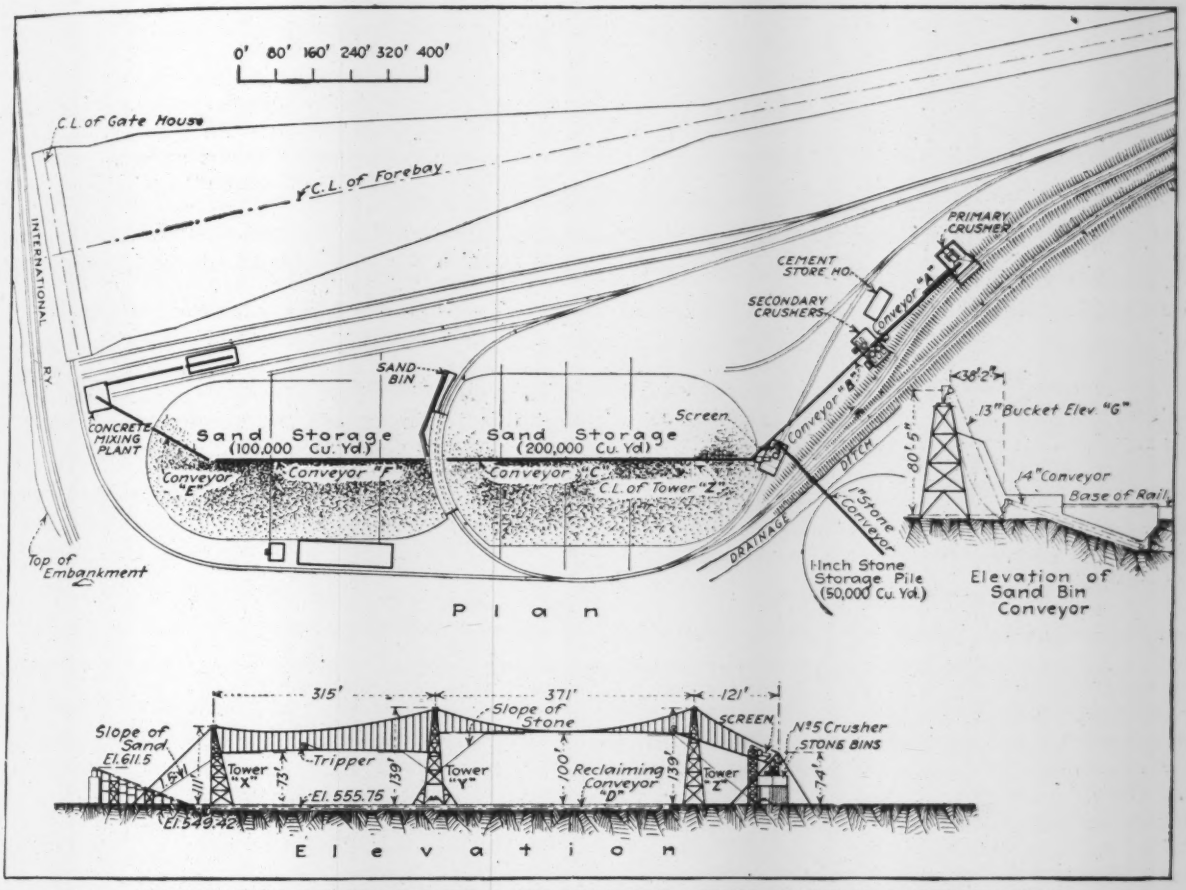
Under the storage pile is a gallery containing another conveyor for delivering stone to the concrete plant, which it is planned to build as shown in the layout drawing.

The rock-excavation work on the canal itself is carried out in such a way as to produce smooth sides and secure the maximum flow. It is the intention to channel the rock down to the water line in advance of blasting, and to break the rock back below this face so as to allow for a 6-in. lining of concrete throughout the entire flow section. There are 15 duplex channelers cutting to a depth of 20 ft. at one operation on the work, most of them being at present employed around the forebay. The channelers and the tripod drills are operated by compressed air delivered by a 10-in. pipe.

There will be 12 motor-driven compressor units, having a total capacity of 12,000 ft. per minute, on the work. A capacity of 8000 ft. is concentrated at the Whirlpool station in the center of the work now in progress, and the other 4000 ft. is located at Montrose station at the southern end of the line. Six of these machines are now in operation at the first-mentioned station, where one of the main transformer substations for the work is also situated. After-coolers are used on the compressors, and it has not been necessary to employ reheaters, although these may be resorted to in cold weather. At present the loss of pressure in delivery from the central station to the drills in the forebay is about 3 lb. per square inch, the drills taking air at a little more than 100 pounds.



Elevation of Conveyors "A" and "B"



LAYOUT OF CRUSHING, CONVEYING AND CONCRETE MIXING PLANT AT POWER HOUSE

Because plenty of electric power was available, and because shipments of coal are becoming more and more difficult to obtain promptly, electric power was used wherever possible on the work. As stated, the haulage equipment uses 600-volt direct current, transformed by rotary converters at the central stations. The other equipment uses 440-volt alternating current, the lines to the two large electric shovels carrying current at 4000 volts to transformers on the shovels themselves. For the smaller plant units the current is stepped down before being delivered to the machine.

For organization purposes, the work, which is being done entirely by the forces of the Hydro-Electric Power Commission, has been divided into four sections. The first of these includes the deepening of the Welland River. The second is the portion of the main canal from station 0 to station 235, the third is the other half of the main canal from station 235 to the forebay, and the fourth section includes the power house, gate-house and the forebay itself. Sir Adam Beck is chairman of the commission, for which Frederick A. Gaby is chief engineer, Henry G. Acres hydraulic engineer, T. H. Hogg assistant hydraulic engineer and M. V. Sauer designing engineer. The work is in charge of J. B. Goodwin, works engineer, under whom G. H. Angell is general superintendent and A. C. D. Blanchard field engineer. F. W. Clark is assistant field engineer, R. T. Gent plant engineer, and William Snaith office engineer. C. F. Whitney is resident engineer on divisions 1 and 2, George Lowry on division 3, and W. S. Orr on division 4.

United States Helps Engineers To Employment

Placements of engineers during September by the Division of Engineering, United States Employment Service, in Chicago, number 1658. During the same period 5161 engineers registered their qualifications with the division.

Sewage Sedimentation Advised for Cleveland, Ohio

Considered Far More Effective than Fine Screens—Chlorination at Lake Plants—Filtration at River Plant

SEDIMENTATION in two-story tanks for preliminary treatment at all three of the proposed sewage-works for Cleveland, with disinfection of the tank effluent at the two lake plants, the Easterly and Westerly, and with sprinkling filters for final treatment at the Cuyahoga River or Southerly plant, has been recommended by Harrison P. Eddy, consulting engineer, Boston, Mass., in a report made to Robert Hoffmann, chief engineer, Department of Public Service, Cleveland, Ohio. Earlier proposals for sewage treatment at Cleveland were outlined and discussed editorially in *Engineering News-Record* of Aug. 16 and Dec. 17, 1917, pp. 290, 308, 1085 and 1128.

At the two lake plants the main object of sewage treatment is protection of bathers and the prevention of beach fouling and of nuisance from gas-lifted solids, while the river plant is needed to prevent nuisance from putrefaction. Mr. Eddy's introductory summary of his report, with some condensation, follows.

Results With Fine Screens

It has been proposed to pass the sewage through fine screens having $\frac{1}{16}$ x 2-in. slots, and to disinfect the screened sewage with chlorine. This method will remove the large particles of suspended matter and thus prevent substances which are recognizable as of sewage origin from reaching the lake waters and becoming a source of offense. Much of the finer floating and suspended matter would not be removed by the screens, and, while not recognizable, would still be present in the lake waters. This finer matter has been shown to be even more dangerous than much of the coarser matter, on account of the greater number of bacteria contained in the smaller particles.

Of the suspended matter not removed by the screens, some would be immediately carried away from the submerged outlet by the current either in the direction of the shore or away from it, and the remainder would be deposited upon the bottom of the lake in the vicinity of the outlet pipe, in the form of sludge.

The wave action will tend to disperse these sludge deposits from time to time, and will cause more or less of this matter to be carried along by the bottom or by the surface currents, as the case may be. In this way a great mass of such matter may be carried to the shore at times of relatively high wind. In warm weather gas generated in the sludge deposit will cause great masses of it to rise. These masses will gradually become broken up and portions of them will be carried at times to the shore.

In the process of disinfection it is difficult for the disinfectant to penetrate the particles of suspended matter and kill the bacteria inclosed within them, unless very large proportions of disinfectant are used and prolonged periods of contact provided. Tests made at West 58th St. show that even with as large a quantity of available chlorine as 10 p.p.m. the bacteria within the particles of suspended matter will not be killed in a period of contact as long as 30 min., which is as great as will be provided by passage through the submerged outlet pipe.

Sedimentation Far More Effective Than Screening

Efficient sedimentation will remove approximately nine times as much of the suspended matter in the sewage as fine screens, and thereby remove physically a much greater number of bacteria. More important, however, is the fact that the remaining bacteria are in a position to be reached and destroyed by the disinfectant. Thus, not only can a smaller quantity of disinfectant be used, but the process as a whole, when practically applied, will be much more efficient in the removal of bacteria than the fine-screen disinfection process.

In addition to the greater bacterial efficiency of the sedimentation-disinfection process, it should be noted that the sewage will be deprived of the settling solids, so that sludge deposits, either in the vicinity of the submerged outlet pipe or elsewhere, will not be formed to an appreciable extent. It is also true, in my opinion, that this treatment will remove the larger particles recognizable as of sewage origin, at least as efficiently as fine screening.

Objection has been raised to the installation of two-story tanks, the upper for sedimentation and the lower for sludge digestion, on the ground that offensive odors are likely to be produced by such tanks. Such odors are more likely to escape from sludge drawn before it has become thoroughly digested. This, however, is not likely to happen after the first year, and can be avoided by the adoption of available means of control. If, as I have recommended, the sludge be barged to the lake, there should be no danger of trouble from this source. This is an entirely practical method of sludge disposal, and there is no reason to believe that it cannot be indefinitely continued. There is, however, the remote contingency that Governmental regulation may prevent such disposal at some time in the future, in which case it will be feasible to construct sludge-drying beds within buildings of greenhouse construction, for the purpose of drying the sludge. The dried sludge would then be hauled to the country for fertilizer or used for filling. This method of drying and disposing of the sludge can be carried out without danger of creating seriously objectionable odors.

Relative Costs

An Imhoff-tank disinfection plant at the Westerly site, according to my estimates, will cost about $250,000 more than a fine-screen and disinfection plant, at present prices. Under pre-war conditions this difference would have been about $170,000. The total annual charges, including interest and depreciation, for the Imhoff-tank disinfection plant, will be about $14,000 less than for the fine-screen disinfection plant, at present prices, and $10,000 less at pre-war prices.

According to my estimates, the Imhoff-tank plant for the Easterly District will cost about $425,000 more than a fine-screen plant, at present prices, and $285,000 more

at pre-war prices. The annual charges will be about $32,000 less for the Imhoff-tank disinfection plant than for the fine-screen disinfection plant, at present prices, and $20,000 less at pre-war prices.

In my opinion, the protection of the public health and comfort demands the adoption of the Imhoff-tank disinfection process in preference to the fine-screen disinfection process, in spite of the greater cost of installation.

Remarks on Activated-Sludge Process

The state Department of Health indicated its disapproval of the fine-screen disinfection plant for the Westerly District, on the ground that it will not provide sufficient purification of the sewage. In view of this position the fine-screen disinfection plant was modified to include treatment by the activated-sludge process in case it should be found that screening and disinfection did not provide adequate treatment. Subsequently the state Department of Health approved the fine-screen disinfection plant for the Westerly District, provided the city would agree to construct an activated-sludge plant as supplementary to the fine-screen plant after the latter had been in operation for one entire year, if the state Department of Health should find, upon investigation, that further treatment is necessary. The additional cost of the supplementary plant required for the activated-sludge process, based upon the estimates of 1917, is about $600,000.

While this process will provide for a greater removal of the organic matter than either the fine-screen or the Imhoff-tank process, it will not, in my opinion, produce a materially safer water for bathing and other purposes.

Such improvement as might result from this combination of processes would be obtained at a plant cost of at least $350,000 in excess of that of the Imhoff-tank disinfection process. Furthermore, the protection afforded the bathers would not be as great as that of the Imhoff-tank disinfection process, because the activated-sludge process, as proposed, is to be operated only during the bathing season. In the remainder of the year, when the fine-screen plant is in operation, the suspended matter passing the screen will be discharged through the submerged outlet, and the sludge deposits formed in its vicinity will be in a position to be carried to the bathing waters, except in so far as they may have been dissipated by storms and other conditions.

The foregoing discussion of the activated-sludge process applies solely to the Westerly District problem, as plans for the Easterly District plant have not been presented to the state Department of Health. The conditions, however, are so similar that it is to be expected that the state Department of Health will take like action in this case. The addition of the activated-sludge plant for the Easterly District would involve very large expense.

Effect of Storm Overflows

It is unfortunate that storm sewage must be discharged along the waterfront. This will occur on the average about 1% of the time, or 25 to 30 hours, during the bathing season. Under such conditions bathing should be prohibited, and the superintendents of the bathing beaches should be empowered to require the bathers to come out of the water, and to prevent further bathing until after the danger has passed.

To treat storm overflow discharges so as to remove the suspended matter appears to be a very great undertaking and to involve an almost prohibitive expense. Even to disinfect these discharges would involve large annual cost for disinfectant and labor. A further investigation should be made of this whole problem, to ascertain the number and frequency of discharges, the quantity of storm sewage so discharged, the intensity and duration of rainfall required to cause the overflows to go into action, and the effect of the storm sewage upon the bathing-beach waters. Without such data I am not prepared to advise the disinfection of storm sewage discharges.

Southerly District Prevents Different Problem

The problem of the Southerly District is somewhat different from that of the Westerly and Easterly Districts. The objectionable condition to be remedied is obviously the foul state of the river. This problem is therefore primarily one of public comfort and not of public health.

[After discussing the earlier recommendations for (1) Imhoff tanks and sprinkling filters, with sludge drying in glass-inclosed beds and sludge disposal by filling, and (2) the later recommendation for fine screens and sprinkling filters, with recovery of the sludge for fertilizer, as means of treatment at the Southerly or Cuyahoga River plant, Mr. Eddy concludes that the second plan would be "highly experimental," as regards both filter performance and sludge recovery. He then gives comparative cost estimates for this plant, and also the estimated total and yearly costs for all three plants, and a program for construction, as follows:]

My estimates show that the construction cost of the Imhoff-tank trickling-filter plant, under present conditions, will be about $8000 less than that of the fine-screen trickling-filter sludge-recovery plant, and $4000 less at pre-war prices. The annual charges for the Imhoff-tank trickling-filter plant are estimated to be $12,000 less than for the fine-screen trickling-filter plant under present conditions, and $13,000 less under pre-war conditions.

The estimates of the cost of building the [three] plants which I have recommended, are as follows:

	First Cost		Annual Charges Including Interest and Depreciation	
	Present Prices	Pre-War Prices	Present Prices	Pre-War Prices
Westerly Plant	$750,000	$449,000	$88,500	$57,700
Southerly Plant	1,266,000	844,000	103,000	70,000
Easterly Plant	1,456,000	971,000	156,900	98,800
Total	$3,472,000	$2,264,000	$348,400	$226,500

Program of Construction

The aggregate amount required to build all three plants is in excess of the sum available. It is doubtful that Governmental authority can be obtained for such an expenditure for this purpose, under present conditions. In the circumstances, it seems to me that it is a wise financial policy to provide for doing this work gradually, undertaking now a part which will afford a substantial measure of relief from present objectionable conditions and which can be done for a moderate expenditure, and postponing until after the war the remainder, representing the greatest portion of the expenditure. I therefore recommend that racks, grit chambers, disinfection building and equipment, labora-

tory building and equipment and necessary accessories be built now at the Westerly and Easterly plants, and that at the Southerly plant the racks, grit chambers, Imhoff tanks, sludge-drying beds, laboratory building and accessories be provided at the present time.

These features will all be required by the complete plants. The disinfectant can be liberally applied—as much as 10 or more parts available chlorine per million—to secure a substantial reduction in the number of bacteria. This program will permit of treating the sewage at both the Westerly and Easterly plants, which is preferable to the expenditure of all the money at one plant, as the conditions and requirements are virtually the same in both localities.

The estimates of construction cost and of operating expense, not including fixed charges, of the portions of the plants recommended for immediate installation, are as follows:

	Present Prices	Operating Costs
Westerly Plant	$116,000	$36,200
Southerly Plant	498,600	19,000
Easterly Plant	234,300	72,200
Total	$848,900	$127,400

Highway Reconstructed and Kept Open for War Traffic

Bad Stretches Rebuilt in Two Sections and Connected With Old Bituminous Macadam Surfacing—Special Bond Between the Two Sections Provided

RECONSTRUCTION of a badly damaged bituminous-macadam highway, where no détours were available, without closing the road to the present heavy war traffic, has been accomplished by the New York State Highway Department by the building of concrete slabs in two parallel sections with a longitudinal joint along the center of the road. The work was planned so as to use the smallest amounts of construction materials possible and to keep the highway passable by repairing only those portions which had given way. By this means materials which are now so hard to obtain were conserved. Of the seven miles of road repaired, three miles were reconstructed in 15 stretches, the longest of which was 9600 ft., the second longest 1060 ft., the shortest only 100 ft. The same method of construction was followed on all the stretches.

During the spring of 1918 heavy motor-truck transportation did great damage to the main roads in New York State, as it did in many other states. The principal damage was done as the frost was going out in the spring, when the saturated subgrades were unable to bear the loads put upon them by the increased industrial traffic due to the monopolizing of rail transportation by war business, and by the many Government motor-truck trains going overland to the seaboard.

This destruction was particularly pronounced on those roads of the macadam type which were without beam strength to bridge over the soft places. Hard-surfaced roads having permanent foundations suffered little damage, but those of lighter construction were practically destroyed. Roads which had carried a similar traffic throughout the winter and which would, it is believed, have carried the traffic during the dry summer months, went to pieces during the spring break-up, as predicted by highway officials. Though various means were suggested for keeping traffic off the roads at that time, no practicable solution of the problem was found.

The highway in question, which was reconstructed as noted above, was of the bituminous type, and was on Route 6, between Canandaigua and Geneva, being the main east and west highway through the central portion of the state. It was originally a 6-in. water-bound macadam road. This had been surface treated at various times and had received a bituminous resurface, being built up to an average thickness of about 8 in. It varied in width from 14 to 16 ft. and had a 4-in. crown on the surfacing and a 28-ft. width between ditches. Being one of the roads of heaviest traffic, when the spring break-up came without any let-up of this traffic, but rather with an increase in loading, it became almost impassable in many sections, as is shown in one of the illustrations. Immediate reconstruction became necessary to save the original investment.

Since there are no parallel roads capable of carrying heavy traffic, détours were out of the question, and how to repair the road without interfering with the traffic

BREAKUP BY HEAVY TRAFFIC AS THE FROST LEFT THE SUBGRADE OF THE HIGHWAY

presented a problem. It was finally decided to build it in two sections, using one-half while the other was being constructed. This arrangement is stated to have worked very well, it being necessary only to locate passing places on the shoulders here and there to insure practically uninterrupted passage. The fact that the new slab was constructed only where needed, and in short stretches, allowed the passage of vehicles on the unbroken sections, and it was only on the longest stretches that special passing places had to be provided.

Designing of the slab was begun as soon as the bad condition of the road became known in the spring, and a half section of the plan finally adopted is shown in the drawing. An average depth of 7 in. was used—8 in. at the center and 6 in. at the edges. As the subgrade is flat, this gives a crown of ¼ in. to the foot, providing for prompt drainage of the water to the side ditches. The position of the slab with reference to the old surface and the new shoulders, together with the various di-

mensions are shown in the section. To bond the two sections of the slab together a V-shaped groove was formed on the inner edge of the first section of slab to be laid, and when the second section was laid care was

POSITION OF CONCRETE SLAB WITH RESPECT TO OLD SURFACING—CROWN REDUCED

taken to tamp the concrete well into the groove so as to get as good a connection as possible. While the designers do not think this will keep the various expansion and heaving forces from forming a hair crack along the central joint, they believe it will prevent the surfaces from getting out of position with respect to each other, and thus prevent the wear which would occur at this point from an uneven surface. The V-shaped bond can be readily seen in one of the photographs.

Early in the season a contract was let for the work which provided that all materials for the job would be furnished by the state, and that, upon order from the contractors, the materials would be shipped to designated sidings by the material company. The contractor's bid

FINISHING INITIAL SLAB—NOTE BOND GROOVE IN EDGE OF SLAB, SQUARE HAND FLOAT AND TEMPLET

covered grading, hauling of materials, construction of the concrete slab, connection of this slab with the old macadam surface and the finishing of the shoulders and ditches while maintaining traffic over the road.

Every effort was made to conserve labor. The rough grading was done entirely by machinery. It consisted of scarifying the old macadam and pulling the material to the sides to reduce the crown, which was too high for a concrete pavement. The scarifying was done by teeth attached to the road machine, which afterward with its blades threw the material to the shoulders. The road machine was hauled by a steam roller, and the labor required was that of two men, one to run the roller and the other to operate the road machine. The scarifying and shaping was carried on for the entire width of the road and when it was completed very little hand grading was necessary to obtain the desired flat subgrade. This force was able to rough-grade about 800 lin.ft. of 15-ft. road per 9-hour day, at an approximate cost of about 3c. per square yard.

When the rough grading was completed the fine grading was done by hand labor. Instead of fine-grading the entire section, the contractors finished only that portion which was to be constructed immediately, while the other half was kept open for traffic. The fine grading was done by the mixer gang, which consisted of a foreman and 16 men. About three hours was required for this gang to fine-grade an 800-ft. stretch which had been rough-graded by means of the road machine and steam roller. This gave an approximate total cost for the scarifying and reshaping of about 6c. per square yard.

The forms for the concrete slab were made of 2-in. plank. The outside form was 2 x 6 in., while the inside form was 2 x 8 in. with a V-shaped piece of wood spiked to it to form the groove. This V-shaped piece was made by sawing a 2 x 2 on the diagonal. Instead of carrying the groove continuously from one end of the plank to the other, it was found more convenient to form it in 6-ft. lengths with a 5-in. space between, thus giving a place to drive the iron rods which held the forms in place. Forms in position and materials delivered ready for concreting are shown in one of the illustrations.

Motor trucks were used to deliver the crushed stone and cement after the forms had been placed, the sand being dumped in advance upon properly-leveled spots on the shoulder. The stone was dumped directly upon the subgrade, while the cement was piled as shown in the illustration. Ordinarily, the cement was placed along the middle form, as shown, at proper intervals to be fed into the mixer. The large pile on the stone was being placed for covering up.

Stone for this work was of the No. 2 size and was Niagara limestone from quarries in the vicinity of LeRoy, N. Y. This is a hard, flinty limestone considered of excellent quality. The sand was well-graded Niagara River grit. Cement, sand and stone were mixed in the proportion of 1:1½:3, the usual charge being two bags. Tamping and shaping of the concrete base was accomplished by means of a templet formed by spiking together three 2-in. plank stood on edge, with handles passed through them near the ends. This gave a 6-in. bottom surface, which was cut to the proper crown and shod with sheet iron ¼ in. thick. The templet may be seen just behind the finisher, in one of the illustrations. In forming the concrete, the templet was used both as a strike and as a tamper, being moved gradually ahead as it was moved up and down, and it was heavy enough to consolidate the concrete without heavy striking, which would affect the grade on the forms.

When the slab had been formed as above, and after sufficient time had been allowed for the concrete to stiffen, it was finished with a large wooden float 18 in. square, as shown in the view mentioned above. After being finished in this manner the surface was broomed crosswise with a coarse wire stable broom to break up the film of mortar on top and give a slightly ribbed surface. This brooming is said to overcome scaling of the surface and it is reported also that it prevents the surface from becoming slippery for a long period of time.

CONSTRUCTION LAYOUT FOR INITIAL SLAB—MATERIALS DELIVERED AND TRAFFIC MAINTAINED

Expansion joints ¾ in. thick were placed at intervals of about 30 ft., in such a manner as to stagger on the two sections of the slab. No special clamp was used to install these joints. When it was desired to place a joint, iron pins were driven into the subgrade, and a steel plate, having its upper edge cut to the contour of the surface, was placed against them. The expansion strip, consisting of premolded asphalt, was rested against this plate until the concrete had been placed on both sides of the joint, after which the plate was removed. The width of the slab being only 9 ft., this method was feasible.

Great care was taken to protect the work after it was laid. While the concrete was still wet on the initial section, iron rods ⅝ in. in diameter and looped at the upper end were forced through to the subgrade. These were placed about 15 ft. apart and were designed to support a wire along the edge of the initial slab to keep traffic from getting upon the other slab before it was sufficiently cured. These iron rods were loosened soon after the concrete had taken its initial set, so that they could be removed when there was no further need for them. When they were removed, the holes which they had formed were grouted with cement grout. The rods with the wire supported by them can be seen in one of the photographs. To protect the concrete from the sun while curing, the usual heavy covering of earth was used and was kept moist for several days. The gang used for laying the concrete slab is shown in Table I.

TABLE I.—CONCRETE GANG AVERAGED 500 FEET PER DAY OF 9 HOURS

1 foreman at $6	$6.00
1 mixer man at $5	5.00
1 fireman at $4.50	4.50
2 form men at $4.50	9.00
3 stone wheelers at $4.50	13.50
2 sand wheelers at $4.50	9.00
4 stone shovelers at $4.50	18.00
2 sand shovelers at $4.50	9.00
4 concrete shovelers at $4.50	18.00
2 cement men at $4.50	9.00
1 finisher at $4.50	4.50
Total	$106.50

COMPLETED ROAD—ONE SECTION CURVING AND WIRE GUARD LINE IN PLACE

The average day's work for the gang was 500 ft., while the greatest day's work was 750 ft., giving a labor cost per cubic yard of approximately $3.30, to which must be added plant rental and the cost of delivering materials upon the work. After sufficient time had been allowed for the concrete slab to set on any stretch, a connection was made with the old bituminous macadam by filling in with the same kind of material. This received an easy taper to the old work at a distance of about 12 ft. The contractor was paid for these connections by the piece. When any section of the base was ready for traffic it was properly cleaned, the

iron rods and guard wire were removed, and the section was opened.

Contract prices for the different parts of the work are given in Table II.

TABLE II.—CONTRACT PRICES

Earth embankment, per cubic yard	$1.00
Scarifying and reshaping, per square yard	0.17
Constructing concrete slab, per cubic yard	5.90
Maintaining traffic, per lineal foot	0.10
Junctions with old pavement, each	15.00

The earth embankment consisted in trimming the shoulders and ditches.

A completed section of the road with a curve banked to take high-speed traffic is shown in an illustration.

All reconstruction work of this character is carried on under the maintenance bureau of the Highway Department, of which F. W. Sarr is head as second deputy commissioner of highways; he works through the division engineers of the various divisions. The work described was carried on under Perry Filkin, division engineer, seventh division, and H. G. Hotchkiss, superintendent of maintenance. A. F. Hinman, the county assistant engineer, was in charge of the work. The contractor was the Greenfield Construction Co., Hornell, N. Y. H. G. McGibbons was superintendent for the contractor.

CURVE SUPERELEVATED FOR HIGH-SPEED TRAFFIC

How the War Industries Board Controls Building

Building Materials Section Passes on All Applications for Proposed Work, Which Come Through State Councils of Defense, and Coöperates With Materials Producers' Committees

CIRCULAR 21, the famous order of the War Industries Board which practically prohibited all but war building in the United States, was issued Sept. 3. Since then every bit of contemplated construction has had to be approved by some Governmental agency which ultimately reports to the War Industries Board. To take care of this new control the Building Materials Section of the board, under the chairmanship of Richard L. Humphrey, has been expanded to a size far beyond what was contemplated when it was organized.

Committees Represent Each Industry

One of the first acts following B. M. Baruch's acceptance of the chairmanship of the War Industries Board was the organization of the Building Materials Section. Rapidly thereafter, War Service Committees were formed under the direction of the section, with a representative in Washington to serve as the point of contact by which the Government requirements are communicated to the industry, and by which the problems of the industry are communicated to the War Industries Board. These War Service Committees are composed of group representatives, each representing a group of manufacturers or producers, so that all the groups represent the entire country. These group representatives are elected or confirmed by a vote of all the producers or manufacturers in the group.

The War Service Committees are bureaus of information as to facts relating to the industry, and they represent the industry in matters which affect the fuel supply, curtailment in operation, prices, and other similar problems that are under consideration by the several agencies of the War Industries Board, or the several Government construction bureaus. When information is desired, the request is communicated to the Washington representative, who in turn communicates with the group representative, and he notifies the rest of the group; in this way an answer is obtained. There are, at the present time, some 36 War Service Committees, and 20 representatives are stationed in Washington.

Materials Section Has Many Functions

The Buildings Materials Section is engaged in the following principal activities: (1) Collation of data as to resources, available stocks and capacity of various manufacturers and producers of building materials; (2) keeping a record of rates of production and delivery on various Government purchases; (3) forming standard specifications and details which serve as a basis for the purchase of various building materials, whereby the greatest conservation of labor, fuel and metals is attainable; (4) regulation of fuel supply for the building materials industry; (5) permits and clearances for building materials required in permissible construction; (6) analysis of cost data, in so far as they relate to prices; (7) handling detailed problems of the various building material industries, in order to enable these industries to meet their problems in the most efficient way.

The section has as members representatives of the War Department, the Navy Department, the Marine Corps, the Emergency Fleet Corporation, the Treasury Department, the United States Railroad Administration (a chairman and a representative of each of seven regional advisers), the Panama Canal Commission, and the United States Housing Corporation.

Frequent meetings are held between these representatives, representatives of other sections of the War Industries Board, and the War Service Committee representing the various building materials industries, to dis-

cuss the various problems relating to building construction. Standards have already been approved for composition roofing, mill work, window screens and doors, building hardware, gypsum plaster and wall board, fiber wall board and lighting fixtures, and there are now under consideration standards for heating and sanitary apparatus, electrical materials, slate and clay roofing, and paints.

How Building May Be Permitted

In accordance with the revisions of circular No. 21 the erection of buildings throughout the country is now possible under the following conditions:

No building operation can be undertaken without a license issued by the War Industries Board. If the building is for Government purposes or is an extension to an industrial plant engaged in work for the Government, the license is issued by the New Facilities Section. If the building is for essential purposes, but not directly contributing to the winning of the war, the license is issued by the Nonwar Construction Section.

Applications for a license for work of the first class must be made to the New Facilities Division if built by the Government, or to this division through the regional adviser of the Resources and Conservation Section of the War Industries Board if the construction is necessary for the winning of the war. If such an application is approved, a license is issued by the New Facilities Division.

Applications for the latter class must be made through the local and state Councils of Defense; if the application is approved, it is forwarded to the Nonwar Construction Section; and if favorable action is taken here, a license is issued. The names and addresses of these several bodies are given in the accompanying table.

Copies of such licenses are sent to the Building Ma-

STATE BODIES WHICH EXERCISE PRELIMINARY CONTROL OVER ALL BUILDING IN THE UNITED STATES

State	Body	Executive Head	Address
Alabama	State Council of Defense.	L. M. Hooper, Chairman	State Capitol Montgomery
Alaska	Territorial Council of Defense	John Marshall, Executive Secretary	P. O. Box 1097, Juneau
Arizona	State Council of Defense.	C. E. Adams, Vice-Chairman	War Work Bldg., Phoenix
Arkansas	State Council of Defense,	Wallace Townsend, Director	1104 Boyle Bldg., Little Rock
California	State Council of Defense.	Charles C. Moore, Director	Ferry Bldg., San Francisco
Colorado	State Council of Defense.	D. W. Thomas, Secretary	State Capitol, Denver
Connecticut	State Council of Defense.	Joseph W. Alsop	State Capitol, Hartford
Delaware	State Council of Defense	Everett C. Johnson, Director	State Capitol, Dover
District of Columbia	Dist. Council of Defense..	William H. Baldwin, Chairman	502 District Bldg., Washington, D. C.
Florida	State Council of Defense.	H. S. Howard, Secretary	State Capitol Tallahassee
Georgia	State Council of Defense.	Price Gilbert, Chairman	State Capitol Atlanta
Idaho	State Council of Defense.	Joseph Hansen, Secretary	428 Idaho Bldg., Boise
Illinois	State Council of Defense.	Samuel Insull, Chairman	120 W. Adams St., Chicago
Indiana	State Council of Defense.	John V. Wilson, Secretary	State House, Indianapolis
Iowa	State Council of Defense.	H. J. Metcalf, Executive Secretary	State House, Des Moines
Kansas	State Council of Defense.	J. C. Mohler, Secretary	State Capitol, Topeka
Kentucky	State Council of Defense.	E W Hines, Chairman	Inter-Southern Bldg., Louisville
Louisiana	State Council of Defense.	John Marshall, Executive Secretary,	State Capitol, Baton Rouge
Maine	Committee on Public Safety	H P Gardner, Executive Secretary,	Blaine Mansion, Augusta
Maryland	State Council of Defense.	Lynn R. Meekins, Secretary	Union Trust Bldg., Baltimore
Massachusetts	Committee on Public Safety	Henry B Endicott, Executive Manager,	State House, Boston
Michigan	War Preparedness Board,	Col. Roy Vandercook, Secretary	State Capitol, Lansing
Minnesota	Commission of Public Safety	H. W. Libby, Secretary	State Capitol, St. Paul
Mississippi	State Council of Defense.	Prof. W H. Smith, Acting Chairman	Agricultural College
Missouri	State Council of Defense.	F. B. Mumford, Chairman	Columbia
Montana	State Council of Defense.	Charles D. Greenfield, Secretary	State Capitol Helena
Nebraska	State Council of Defense,	George Coupland, Vice-Chairman	Bankers Life Bldg, Lincoln
Nevada	State Council of Defense.	H. A. Lemmon, Director	Reno
New Hampshire	Committee on Public Safety	John B. Jameson, Chairman	State House, Concord
New Jersey	State Council of Defense.	C H. Anderson, Secretary	State House, Trenton
New Mexico	State Council of Defense.	Walter Danburg, General Secretary	Santa Fe
New York	State Council of Defense.	William A. Orr, Secretary	State Capitol Albany
North Carolina	State Council of Defense.	D. H. Hill, Chairman	Raleigh
North Dakota	State Council of Defense.	Thomas Allan Box, Secretary	State Capitol, Bismarck
Ohio	State Council of Defense.	J. L. Morrill, Secretary	State House, Columbus
Oklahoma	State Council of Defense.	C. H. Westfall, Assistant Secretary,	State House Oklahoma City
Oregon	State Council of Defense.	J. K. Kollock, Executive Secretary	311 Corbett Bldg., Portland
Pennsylvania	State Council of Defense.	Lewis Sadler, Executive Secretary	7th Floor Finance Bldg., Philadelphia
Rhode Island	State Council of Defense.	Capt. Geo. H. Webb, Director	State House, Providence
South Carolina	State Council of Defense.	Reed Smith, Secretary	Union National Bank Bldg., Columbia
South Dakota	State Council of Defense.	George W. Wright, Secretary	Huron
Tennessee	State Council of Defense.	Major Rutledge Smith, Chairman	State Capitol, Nashville
Texas	State Council of Defense.	Judge J. F. Carl, Secretary	521 Bedell Bldg., San Antonio
Utah	State Council of Defense.	Arch. M. Thurman, Secretary	State Capitol, Salt Lake City
Vermont	Committee of Public Safety	Joseph G. Brown, Secretary	Montpelier
Virginia	State Council of Defense.	C. R. Keiley, Secretary	State Capitol, Richmond
Washington	State Council of Defense.	M. P. Goodner, Director	State Capitol, Olympia
West Virginia	State Council of Defense.	Jesse V. Sullivan, Secretary	State Capitol, Charleston
Wisconsin	State Council of Defense.	James B Borden, Executive Secretary,	State Capitol, Madison
Wyoming	State Council of Defense.	Maurice Grosbon, Chairman	P. O Box 115, Cheyenne

terials Section, whence issues upon application a permit by which the desired materials may be obtained. If the work involves the use of a material that by reason of shortage is being allocated, the substitution of some other material is suggested, or if the material requires a priority rating—for example, steel—the application is sent to the Priorities Division for the necessary rating. With this license, the contractor may obtain from the manufacturer or producer the building material required.

Producers' Pledge Is Signed

The building material producers or manufacturers are placed into the honor system by the Priorities Division; they sign the following pledge and must apply for a place on the preference list to obtain preferential treatment as to fuel, transportation and labor:

"The undersigned hereby pledges itself not to use, nor so far as lies within its power permit to be used, any products of its manufacture now in, or which may hereafter come into its possession or control, save (a) for essential uses, as that term has been or may be defined or applied from time to time by the Priorities Division of the War Industries Board, or (b) under permits in writing, signed by or under authority of such Priorities Division; that it will make no sale or delivery of such products to any customer for resale until such customer has filed with it a similar pledge in writing, and that it will use its utmost endeavor to insure that its products shall be distributed solely for essential uses."

The producer or manufacturer in turn obtains the same pledge from his dealers or distributors, or the user, where the material is required in the manufacture of products that are to be offered for sale. Each dealer or distributor must render a monthly statement on the 15th of each month to the manufacturer or producer whose materials he sells, showing the use of the materials sold during the preceding calendar month. The manufacturer or producer in turn submits a similar statement to the Building Materials Section for each calendar month. In the event of the manufacturer or producer, or the distributor or dealer, being unable to determine whether the proposed use is one contributing to the winning of the war, he must make application to the Priorities Division for a ruling on the question.

The War Industries Board holds that in general construction that is not essential to civilian life, or that does not contribute directly or indirectly to the winning of the war, or which may be deferred until after the war, should not proceed at this time. Under the above system, it is thought that no building will be undertaken that is not of this character. The above, however, does not apply to such repairs of and extensions to existing structures as do not exceed $2500, or to work on the farm the total cost of which does not exceed $1000.

Highway Work Under Different System

For the maintenance, reconstruction and construction of streets, pavements and highways, it is necessary to obtain a permit from the United States Highways Council. This council is composed of representatives of the Department of Agriculture, the United States Fuel Administration, the United States Railroad Administration, the War Department, the War Industries Board and representatives from the Capital Issues Committee and the United States Employment Service. It meets on Monday of each week and sits to pass upon various applications for permits for work for municipal, county or state highway construction. Applications must be made to the state highway department and through it to the United States Highways Council; they are then considered by a subcommittee and, if favorably acted upon, are referred for approval to the several representatives of the Government department on the council.

By reason of local congestion and other problems, it has been necessary for the Building Materials Section to establish branch offices in New York and its vicinity, Philadelphia and its vicinity and Norfolk and its vicinity. At these points, the demand for sand, gravel, crushed stone, brick and other building materials has been so great that in order to avoid confusion and to supervise properly the deliveries of these materials, it has been necessary to establish branch offices. In these cases the several Government departments make application to the representative of the branch office, who advises as to the manufacturer or producer with whom the order should be placed.

How Orders Are Allocated

Where a license has been granted for a project, whether it be for war work or nonwar work, application must be made to the Building Materials Section for clearance and, if a price has been established, for allocation. The recommendation as to the manufacturers or producers with whom the order should be placed, and the price to be paid, will be furnished by the Building Materials Section. This order is placed with the nearest available manufacturer or producer, so as to involve the least possible transportation. When the manufacturers or producers nearest to the given point of consumption have received orders for all the material they can furnish the orders are then placed with the nearest manufacturer or producer who can furnish the material. In this way the transportation is reduced to a minimum and an equitable distribution of Government orders is effected among the several manufacturers or producers, and the confusion resulting from placing orders is avoided. When one department purchases without regard to another, it frequently happens that a manufacturer or producer will receive more orders than he can fill, while his neighbor has very little business. The result is that the greatest efficiency in deliveries is impossible.

When the Government demand for materials takes the major part of the available supply, it is necessary to allocate this supply to the several Government departments; in order to obtain an efficient and equitable distribution of the material it is necessary for the Government to fix a price. In establishing fair prices, the Federal Trade Commission makes an investigation of the books of the various manufacturers or producers and renders a report of its findings to the Price-Fixing Committee of the War Industries Board. The Commodity Section, or the Building Materials Section in this case, conducts the preliminary negotiations with the industry and arranges for a hearing of the industry

before the Price Fixing Committee. When the industry gets a hearing the Price-Fixing Committee establishes a price, on the evidence presented by the Federal Trade Commission and by the industry. This price covers the cost of production plus a proper allowance for overhead expenses, including selling expenses and depreciation, and a profit depending on the turnover in the industry.

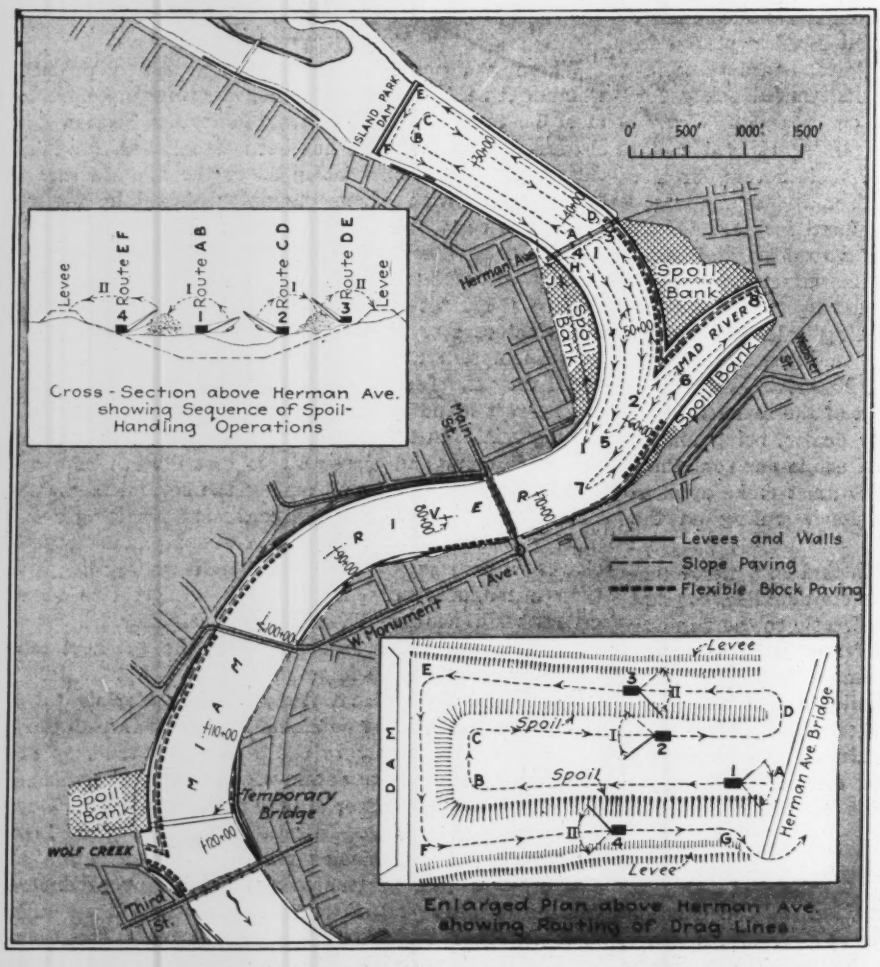
Such prices are generally fixed for both the Government and the public and are subject to review at fixed intervals of about three or four months. Prices have been fixed for the following building materials: Iron and steel, lumber, portland cement, hollow building tile, and, in the metropolitan districts of New York and Philadelphia, the prices for sand, gravel and crushed stone.

Draglines Twice Handle Spoil from Dayton Flood Channel

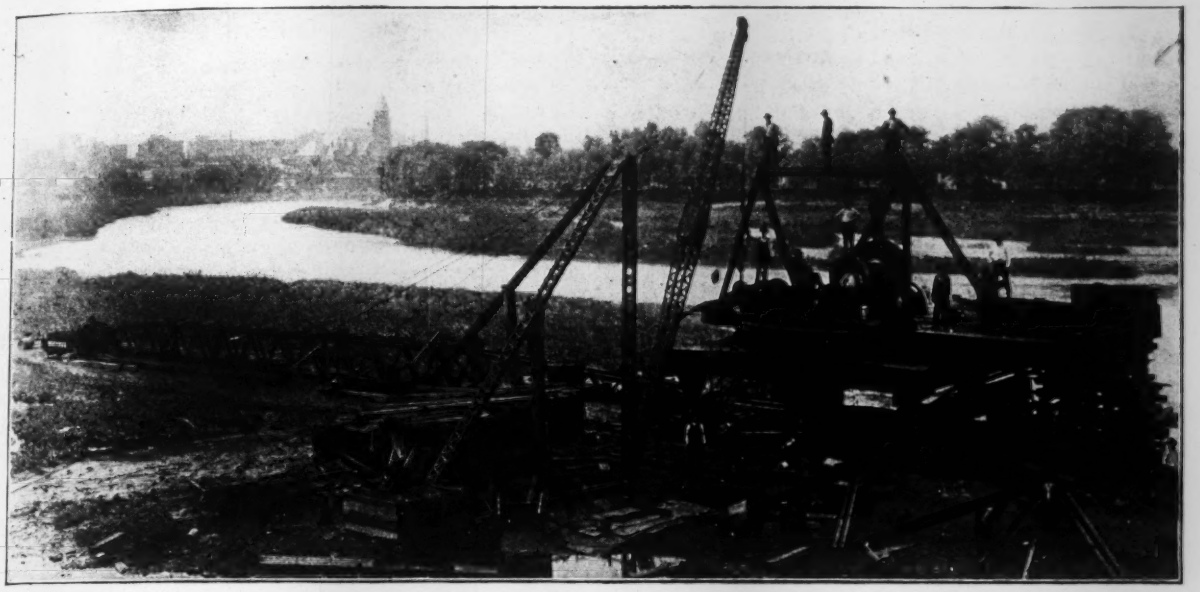
Excavator Mounted on Barge Will Dig Channel and Load to Other Scows Which Will Be Unloaded by Machine Standing on Bank

SEVERAL hundred thousand yards of material will be handled twice by dragline excavators, in improving the channel of the Miami River through Dayton, Ohio. Temporary pools are to be formed in the river by light timber dams, to give flotation for scows. One dragline mounted on a scow will excavate the channel and load onto other scows which will be towed to the spoil bank and there unloaded by a second dragline standing on the bank.

The local protection work at Dayton extends along the Miami River for a length of about eight miles. Of this distance, about five miles of the channel is to be enlarged by dredging. In addition, protection work is required for those portions of the Mad River and Wolf Creek which lie within the city limits. In the five miles of river dredging about 2,000,000 cu.yd. are to be excavated. About one-half of this distance is within a section of the city fully improved with streets and buildings, so that the opportunity for spoiling the material is small. Within the limits of this section there are to be excavated about 900,000 cu.yd.; most of the material is to be transported to spoil banks lying at the intersection of the Mad and Miami Rivers and at the mouth of Wolf Creek. It is for this excavation that dragline excavators are to be used, and a large part of the excavated material will be handled twice. Excavation was begun this summer on the upper section of the Dayton channel improvement shown by the accompanying map. Symbols on this map define the locations of levees and walls, of slope paving and of spoil-disposal areas. Spoil disposal, it will be observed, is largely concentrated in three areas near the confluence of the Mad River with the Miami. Another area near the mouth of Wolf Creek, however, cuts down the haul from a portion of the central section of the channel excavation. Preliminary work, such as assembling and fabricating plant units and getting them installed, is a large part of the first season's task, although first and last a considerable volume of excavation will be accomplished. Broadly speaking, the task involves erecting and installing the excavators, putting



TEMPORARY DAM FOR SCOW HANDLING OF MATERIALS; DOTTED LINES SHOW DRAGLINE OPERATIONS PRIOR TO SCOW HANDLING

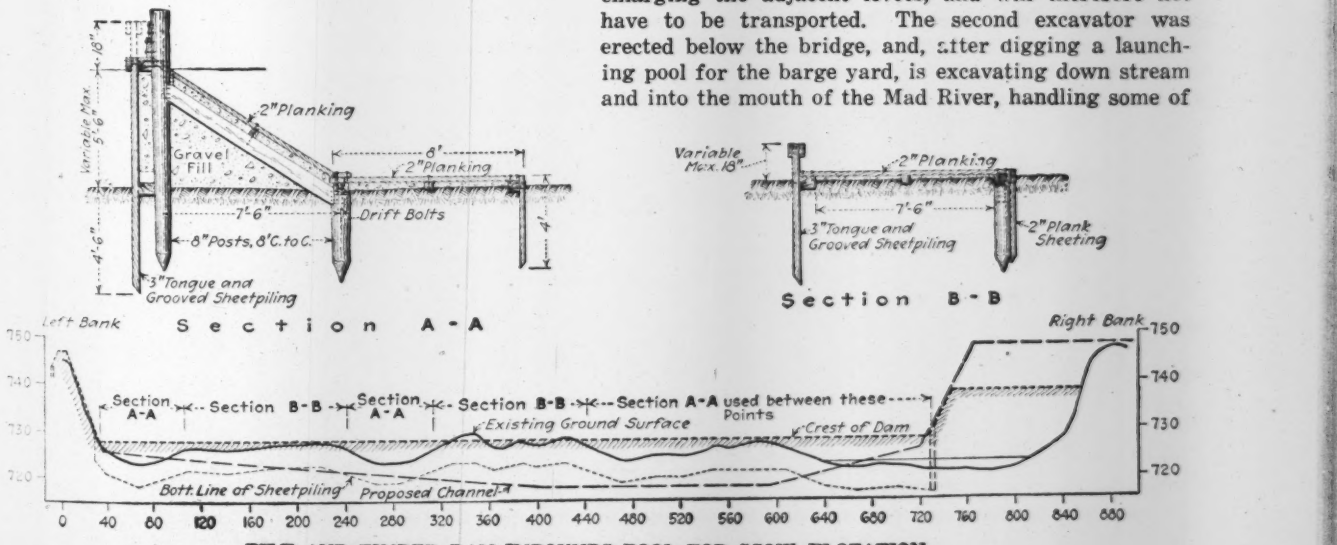


DRAGLINE PARTS MADE FIVE-CAR TRAINLOAD AND REQUIRED DERRICKS FOR ERECTION

the excavators at work on preliminary channel excavation, building and launching barges and constructing a temporary dam to form the pool. The desirability of carrying the excavation downstream and the availability of sites for erecting the excavators and for building and launching barges, besides the possibility here for considerable channel excavation without barge transportation, determined the start of the work near the Herman Ave. bridge.

Two excavators of the revolving dragline type were installed for the work. Both, at the beginning, were on the regular truck mountings for shifting on track. These are similar machines. As erected for preliminary excavation prior to being mounted on scows, one is fitted with a 125-ft. boom and a 3½-cu.yd. bucket, and one with a 100-ft. boom and a 4½-cu.yd. bucket. Before transportation by scows is begun the 100-ft. boom length will be increased to 135 ft. and the bucket size will be decreased to 3½ cu.yd. Both machines are electrically operated with 250-hp. main motors and 100-hp. swinging motors. Current is brought by a special five-mile transmission line from the plant of the Dayton Light & Power Co., at 6600 volts. Transformers temporarily housed on the bank in the vicinity of the machines reduce the voltage to 2300, at which intensity it is transmitted to a second set of transformers adjacent to each machine, reducing the current to 440 volts for operating the motors. These transformers are moved from time to time by the draglines and motor trucks. It is proposed later to mount them on small scows, for floating them into positions convenient to the work.

One excavator was set up above the Herman Ave. bridge and is digging the channel to the Island Park dam, following generally the route shown by the dotted line, and rehandling the material. The material excavated in this section will practically all be required for enlarging the adjacent levees, and will therefore not have to be transported. The second excavator was erected below the bridge, and, after digging a launching pool for the barge yard, is excavating down stream and into the mouth of the Mad River, handling some of



PILE AND TIMBER DAM IMPOUNDS POOL FOR SCOW FLOTATION

the material twice and a small quantity three times. In digging out the channel under the bridge the two excavators worked together on opposite sides of the bridge, with buckets connected back to back by a 40-ft. piece of cable, and the machines pulled and slacked off alternately, moving the buckets shuttlewise under the bridge. As set for this operation the two draglines are shown in one of the pictures. When the channel work just indicated is completed the draglines will be restationed for scow work, one being mounted on a barge and the other at the spoil bank.

The general procedure of the dragline work prior to the scow handling is indicated by the map and the diagrams. Starting at A above the bridge, dragline No. 790 will proceed along the general route A, B, C, D, E and F to G; it will then have finished the channel above the bridge. The machine will then be transferred around the end of the bridge to H and proceed to I, rehandling into the levee the spoil thrown back from mid-channel by the other dragline working from 4 to 5. From I to J, machine No. 790 will dig a scow channel traversing the spoil bank area.

The operations of dragline No. 790 above the bridge are indicated in detail by the diagram sketches. Note shown by the pictures. Provided with 24-in. square spuds, it will support the excavator when digging and float it from place to place with the progress of the work. For handling spoil the scows will be 40 x 120 ft. in size. On one side the deck will have a timber bulkhead for the unloading bucket to drag against and to help retain the 400-cu.yd. load.

Sufficient depth of water at all times to float the scows is provided by a pool impounded by a construction dam. This dam is located, as shown by the map, at a point just above the mouth of Wolf Creek, where the channel width is approximately 900 ft., as shown by the cross-section. The dam is a pile-and-timber structure which can readily be removed from the channel when its temporary purpose has been fulfilled.

A 20 x 70-ft. stern paddle wheel, steam-driven tug will be built for towing scows between the point of excavation and the point of unloading.

Channel excavation by the plan outlined calls for skillful coördination of spoil-bank volume and location, scow travel, loading and unloading time, and routing of the excavator doing the digging. The digging unit controls; all other plant units serve. Broadly speaking, the greatest economy is attained when the digging unit

DRAGLINE STARTING CHANNEL EXCAVATION AT HERMAN AVENUE BRIDGE

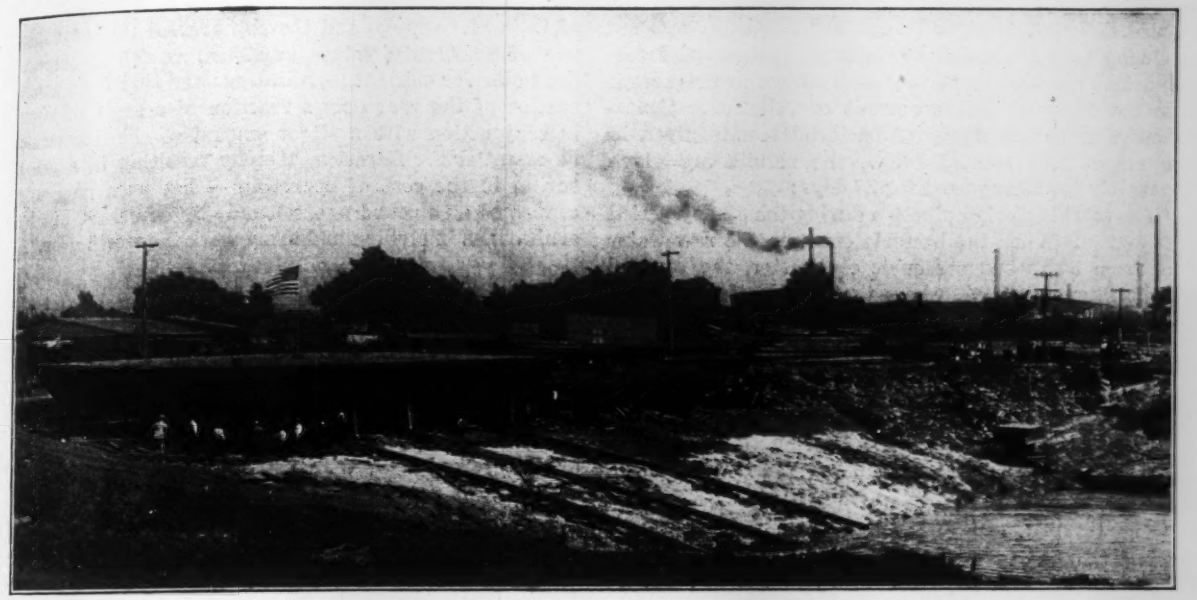
that these sketches indicate the single dragline in four successive positions, and do not indicate four draglines. In positions 1 and 2 the machine is digging from the channel and casting into the spoil bank; in positions 3 and 4 it is digging from the spoil bank and enlarging the channel, casting into the levees.

Below the bridge dragline No. 729 is following the route indicated by the numerals. Like No. 790 it will rehandle spoil as such work is made necessary by the width of the channel. A small portion of the excavation will be handled three times. Machine No. 729 will finish its work at 8 about the time machine No. 790 arrives at J. Immediately, then, one machine will be barge mounted, the opening in the temporary dam will be closed and scow transportation will begin.

Timber deck scows are being built in a temporary yard on the east bank just below the Herman Ave. bridge. Here a launching pool was dredged, and a lumber yard, tool house and launching ways were provided. The scow for the dragline is 40 x 80 ft. and is kept operating always at its maximum practicable output. It is estimated that in this upper channel work three scows can be so routed that the digging unit may never be rendered idle by spoil transportation delays. A similar unloading unit will keep the scows cleared of load as fast as they are needed for the digging unit. At the present time the draglines digging and casting into spoil banks are moving from 1000 to 1500 cu.yd. in a 10-hour shift. When the work is arranged for scow handling it is estimated that an output of 1200 cu.yd. per 10-hour shift can be maintained.

Where the excavation is made adjacent to spoil banks, as that portion immediately south from the Herman Ave. bridge, the material is placed directly into the spoil banks by rehandling with the dragline machines, without the use of scows.

The section of the river below Washington St. flows for the most part through land with space available for the disposal of material, without longitudinal transportation. This section of the channel, however, is of



SCOWS BUILT ON RIVER BANK SIDE LAUNCHED INTO POOL

such width that a considerable proportion of the material will need to be handled twice in order that it may be placed in the embankments at the river's edge. These embankments will be of sufficient width to provide roadways 50 ft. wide, and the available material will be sufficient to afford an appreciable amount of filling upon the low lands that are situated outside of the roadways.

The channel improvement is a portion of the flood protection work of the Miami Conservancy District, of which Arthur E. Morgan is the chief engineer, Charles H. Paul is assistant chief engineer and C. H. Locher is construction manager. J. H. Kimball is construction engineer in general charge of the river improvement work of the district. C. A. Bock is division engineer in charge of the channel work at Dayton.

Drifting-Sand Water-Filter Test Results Reported

Large Mechanical Plant at Toronto Operating Without Precoagulation Held to Meet Contract Requirements

TESTS of the drifting-sand mechanical water filtration plant built for the city of Toronto, Ont., show that the plant complies with contract requirements as to amount of alum used and bacterial removal, according to a report completed some time ago. The results of the tests have just been made available for publication. The report was made by George G. Nasmith, director of laboratories, Toronto Department of Health, and N. J. Howard, bacteriologist in charge of the filtration plant laboratory.

What a Drifting-Sand Filter Plant Is

The Toronto drifting-sand filter plant was described at length in *Engineering News* of Dec. 21, 1916, p. 566. It has a contract capacity of 60,000,000 Imp. gal. in 24 hours. There is no precoagulation. The name "drifting-sand" is used because the upper part of the sand bed is made to drift across the path of the raw influent water. By this means, to quote a statement in the article already mentioned, based on information from the engineers for the plant, "the bulk of the impurities are swept out, together with a part of the drifting sand—the latter being washed and returned by the constant circulation of the water and sand." An account of the contract letting for this plant was printed in *Engineering News* of Apr. 8, 1915, p. 680, and information regarding the drifting-sand filters in an earlier stage was published in *Engineering News* of June 25, 1914, page 1446.

Five filter units of the plant were tested continuously from Dec. 5, 1917, to Jan. 11, 1918, exclusive of Sundays and holidays. The actual number of testing days was 32. During this period 108 samples of raw unfiltered lake water and a like number of samples of filtered were examined bacterially (agar, 37° C.). The bacterial content of the unfiltered water has never extended beyond 520 per cubic centimeter, and that but once. Of the other 107 samples, only 16 ranged from 50 to 500, and 50 showed 10 bacteria per cubic centimeter or less. B. coli tests with 100-c.c. samples were positive in 106 and negative in two samples of raw water, and positive in 93 and negative in 15 samples of filtered water. Using 0.1-c.c. samples the figures were 106 positive and six negative for raw, and all negative for filtered water. The average amount of water filtered daily was 31,333,333 Imp. gal., and the average amount of alum used was 1.02 gr. per Imperial gallon, as compared with a specification requirement of 1 grain. The lake water during the test is described as representing "at least the average, if not worse than average conditions." The turbidity of the raw water varied from 1 to 115 p.p.m.

and averaged 6.6, while that at the effluent never exceeded one part.

Owing to the impossibility of making chemical determinations on four days, the alum dose for those days was not adjusted to the amount of pollution. Consequently, in the summary of bacterial results given in the report and printed below, the results are given separately for 32 days and for 28 days:

"The total bacteria reduction during the 32-day period was 93.9%. When the bacteria count in the raw water was from 50 to 500 per cubic centimeter, the removal by the filter was 97%, where the specifications call for a removal of 90%. Only once was there a bacteria count of more than 500 per cubic centimeter, in which case the removal was 99.4%.

"Excluding four days' results for the reason specified, the total removal was 93.5% of all the bacteria present. When the bacteria count in the raw water was from 50 to 500 per cubic centimeter the removal was 97.2 per cent.

"The total B. coli removal, inclusive of all results during the 32-day period, was 95.8%. Exclusive of results on the four days previously mentioned, the removal was 98%. This is the removal called for in the specifications.

"The difference of 2.2% in efficiency is probably due to the failures cited above, is of no practical significance, and may well be discarded. That this is true may be seen in the results of the B. coli efficiency of the individual filters. These samples from the individual filters were collected at times when there was no disturbance due to hydro [power] failure or to insufficient amounts of alum.

"In the case of the five filters tested separately, the B. coli removal in all cases exceeded 99 per cent.

"From these results it will be seen that the efficiencies and requirements demanded in the specifications have been attained. The difference of 1/50 gr. of alum per gallon over the one grain per gallon specified may be considered a negligible quantity."

Test to Show Time Effect on Alum Use

After completing the report on the contract tests a series of special tests was made to ascertain the comparative results obtained with alum-treated water after 30-minute contact and a 3-hour sedimendation period. For this purpose two small mechanical filters were used in parallel, operating at a rate of 120,000,000 Imp. gal. per acre daily. From 0.5 to 3.5 gr. of alum per Imperial gallon was used. The report states:

"Throughout the whole series the results were uniform, showing relatively small differences, and also establishing the important point that the time element was not a factor in the purification process. Numerous brands of alum were tried and it was found that the purer the alum the better the results."

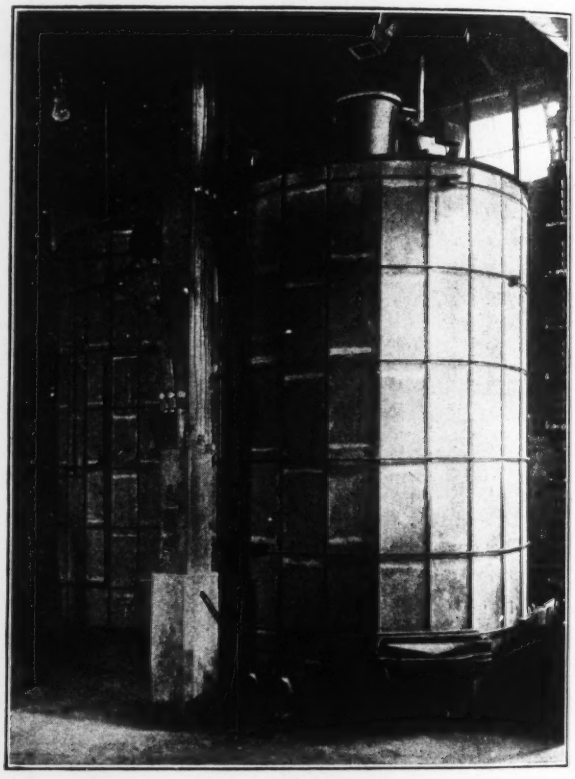
In an addendum to the report it is stated that in the near future chlorination will be adopted. In conclusion, Messrs. Nasmith and Howard say:

"The decision we arrived at when the tender for the mechanical plant was first let—'that our former conception of a filtration plant was undergoing a material change; that sterilization of the water was the vital thing from the public health standpoint, but that a filter was essential to clean the water, keep sand and dirt out of the water-supply, and thereby prevent the wear and tear of machinery, valves, taps, etc., as well as prepare the water for efficient sterilization; and that for a great portion of the year only a fraction of a grain of alum in conjunction with a slight amount of chlorine would be essential for filtration, thereby resulting in a great saving in the cost of operating'— has been generally confirmed as a sound one, not only by ourselves, but by sanitarians in civilian and army work the world over."

Concrete Replaces Steel at Gas Plant

CONCRETE staves used, owing to the shortage in and high cost of steel, in place of steel plates for the 8-ft. shells of a 200-hp. gas producer and scrubber, have proved satisfactory in about 12 months' service.

Tongued and grooved staves 24 x 10 in., 2½ in. thick, are reinforced with wire netting and a waterproofing compound is used in the concrete. While the staves are



GAS PRODUCER HAS SHELL BUILT OF CONCRETE STAVES

flat, the tongue-and-groove joints permit their being built up into a circular shell, which is bound with steel hoops. Cement that is fireproof and waterproof seals the joints. To protect the concrete from the intense heat, a 3-in. space between the staves and the interior firebrick lining is filled with "Sil-o-cell" powder. This filling is also to serve for closing any small checks or cracks, thus preventing entrance of air or escape of gas. Any large cracks could be closed with cement.

The apparatus is at Syracuse, N. Y., at the plant of the Syracuse Industrial Gas Co., which has patents covering the construction.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

St. Paul Society Appeals for Workers

Activities in engineering societies are lagging because many of the "live" pushers are finding such pressing emergency needs elsewhere. An appeal to those who must take up the home problems that are crying for solution is made in the October *Bulletin* of the St. Paul Society of Engineers:

"The usual activities of St. Paul must go on. Every variation from the normal life of the people means a congestion, a lessening in the efficiency of the machinery. The feverish activity in war work has caused the neglect of many things which are very necessary. It is the duty of those of us who stay at home to see that the work is carried on. This is a most difficult time for the St. Paul Society of Engineers. Some of our best workers are gone. Some of our other workers are occupied in war work, but a lot of us are not really busy with anything but our own private affairs.

"The St. Paul Society of Engineers needs your intelligent coöperation. It needs some actual work done by each of you to help hold the society together. There will be no special glory in doing this work. If you want glory you had better go where the bullets are flying, but if you want to do your duty here at home help wherever you can. Get in and work. Don't make excuses when you are asked to do something. Your society needs you!"

Along the same line is an editorial comment in the *Bulletin* of the Illinois Society of Architects, for the architects' societies apparently have the same difficulties in commanding active workers. Here are the views from a sister profession:

"The big problem confronting the executive officers of all architectural societies and other professional organizations is how to secure the loyal support and cooperation of the individual members of the societies. It is undoubtedly true that the majority of members of all technical and professional organizations view their membership in the same way as they view a university degree. They look upon membership in a professional body not as a commission to work with their professional brothers to better conditions, but as a mark of distinction similar to that conferred by a university degree. There is always evidenced on the part of a large number of the more prominent members of all societies a 'holier than thou' attitude and a too little regard for the viewpoint of others."

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

The United States Engineer Officer Who Located the Mexican Railway

Sir—My attention has been called to a letter in your issue of Sept. 19, p. 552, which speaks of the life and service of Capt. Andrew Talcott, and I wish to express not only my interest but also my deep gratification.

I was myself one of the party working on the original survey for the Mexican Ry. in 1858, and under his direction ran the first transit line over the mountain side in the Maltrata Pass. He was an engineer well worthy to be remembered. W. R. EASTMAN.

Albany, N. Y.

Compensation of Engineers

Sir—I have always been of the opinion that one reason for the failure of engineers to obtain proper recognition in the business and commercial world is that, as a class, they signally fail to show any ability in handling their own personal interests.

I refer particularly to the compensation engineers are receiving, especially from the Federal Government at this time. One of the first war moves was to decide that a civilian could not receive the commission of major in the Engineering Corps until he had reached the age of 45. A dry goods clerk or a barber who had reached the age of 35 would be commissioned major in the Quartermaster's Corps or some other branch of the Army, but a rank discrimination was made against engineers right at the very beginning.

I notice that the Government is asking for a number of mechanical engineers, to whom they are willing to pay the salary of $2000 a year. Naturally, they will expect these men to be of mature age and experience. If they were not, they would be already in the Army under the provisions of the draft law. They will also expect these men to be college graduates and men who have handled large industries, and for all this they are going to expect the men to work from 10 to 16 hours a day for $2000 a year. This is less than the Government itself is paying the average locomotive engineer and conductor on the trains that it is operating. In the shipyards, at the present time, the Government is hiring men as machinists who, in times of peace, will be employed as helpers or common laborers, and these men, for nine hours' work, are drawing 9½ hours' pay at 80c. an hour, or $7.60 a day—practically $197.50 a month, or $2370 a year.

Our engineering societies talk a good deal about compensation for engineers, but the societies as a whole seem to be as impractical as the average engineer when it comes to the matter of compensation for services.

It seems to me that the engineering societies ought to go to Washington and arrange a scale for the payment for professional services. They may object to this on the ground that they would thus be getting into the same class as the labor unions. Perhaps it is more desirable to say that you belong to a profession and remain on a high professional basis and starve to death, than it is to belong to a labor union and have your personal affairs conducted in a business-like manner.

CITY ENGINEER.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Pretense of a Tool Record Reduces Loss of Tools by Workmen

"FOR its moral effect on the workmen," says a successful construction superintendent, "make a bluff at a tool record." Experience has shown that on construction work a complete accountability record for small tools is of doubtful economy. For example, the loss of shovels which is prevented by having an inventory system and tool account complete enough to check all losses is not ordinarily sufficient to warrant the accounting expense. A great error, however, is to accept this as an excuse for keeping no records. A record of some sort should be kept, and notice that it is kept should be made conspicuous. The idea is to impress the workmen with the feeling that the property of the contractor is being carefully safeguarded. Local conditions will determine the manner of keeping the record, so that specific directions are of small utility. A few hints are, however, possible. Brand every small tool as soon as it comes from the dealer. Transfer no tools from foreman to foreman or from job to job, except through the tool room. Make a memorandum charge against the foreman or the superintendent for tools issued, and credit him with tools returned. Where possible, furnish the workmen with tool checks and require them to put up a check for every tool delivered to them. A system of following through all or any of the checks named may not be practicable, and it is not essential to obtaining results, for if there are signs that records are being kept the foreman will not know how accurate these may be and will hesitate to "borrow" or "lose" tools, for fear that the records may show their misdeeds. In these days of high cost and scarcity of material, taking such precautions is especially desirable.

C. S. H.

Other Articles of Interest to Contractors In This Issue:

U. S. Engineers Bridge Marne with German Equipment — Page 798

Canada Rushing Huge Niagara Development as War Conservation Measure — Page 801

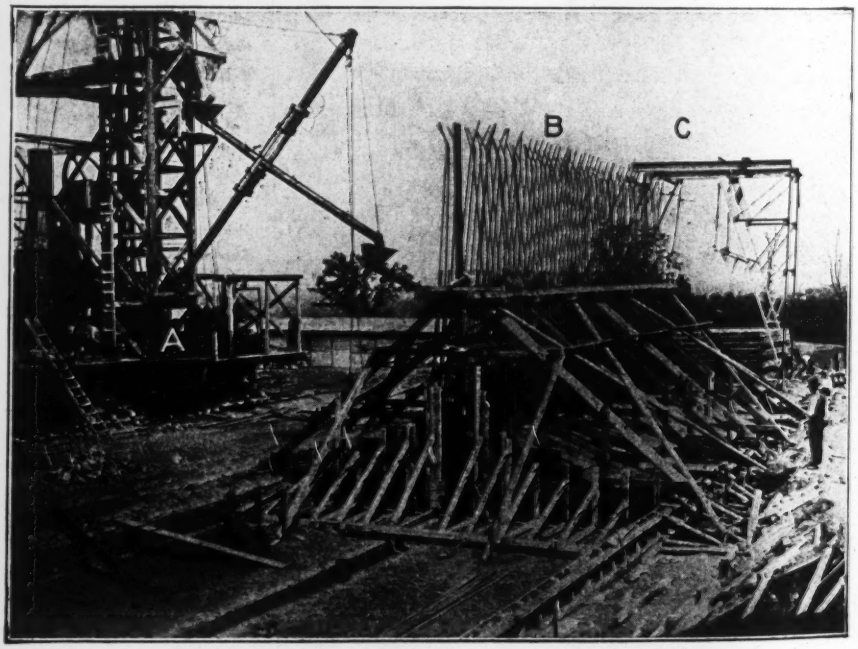
Highway Reconstructed and Kept Open for War Traffic — Page 808

How the War Industries Board Controls Building — Page 811

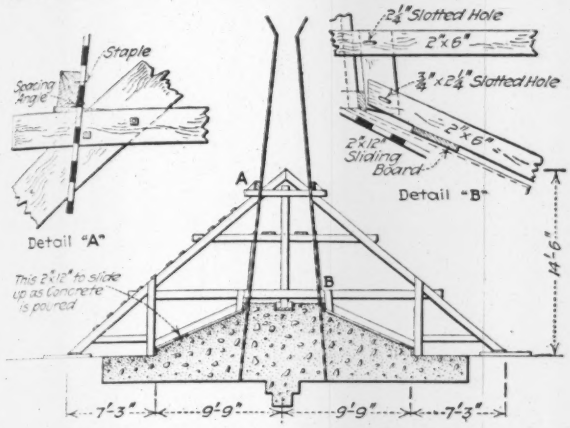
Draglines Twice Handle Spoil from Dayton Flood Channel — Page 814

Superframe on Footing Form Supports Thirty-Foot Wall Bars

REINFORCING bars for the 25-ft. partition wall of the St. Paul, Minn., new high-service reservoir were held upright and to accurate spacing, while the footing was concreted around their lower ends, by a light framework carried on the footing form. The processes of constructing the wall, as indicated by the view, are: (1) Excavating and shaping the footing trench; (2) setting forms and concreting footings; (3) concreting wall in sections between forms supported by a carriage straddling the wall. The details of the footing forms and bar supporting frame are shown by the drawing. In concreting the footing the inclined top surface on each side of the wall was formed by a single board, C, which, starting at the lowest point, was slid up as the concreting progressed. The mixer plant on a track parallel with the wall moved ahead concreting the footing, and then retraced its journey, concreting the body of the wall. The con-



WALL CONCRETING A SEQUENCE OF SCHEDULED OPERATIONS
A—Traveling concrete-mixing plant. B—Reinforcing supported by footing forms. C—Wall forms traveler. D—Trench excavated for footing



SUPERFRAME ON FOOTING FORM SUPPORTS REINFORCING RODS

tractors for the reservoir were the George J. Grant Construction Co., St. Paul, Minn.

Electric Lights in Operator's Cab Show Location of Cableway Bucket

AN indicator board containing 24 numbered electric lights, set up in front of the hoist runner on the cableway on the Queenston-Chippewa power development at Niagara Falls, tells the hoist runner where the bucket is at any moment. The lights on the indicator are lit through a circuit closed by a contact, on the haulage drum, which is made and broken with every revolution of the drum. The lights thus show the progress of and the distance in feet traveled by the bucket out across the river and back again to the dump. The numbers under the lights show the hoist operator the exact digging position of the bucket, and prevent him from making a hole in the river bottom, which would lower the efficiency of loading. The indicator also makes accurate and rapid night work possible.

The device was rigged up on the job under the direction of G. H. Angell, general superintendent. The Hydro-Electric Power Commission of Ontario is doing this work with its own forces. The work is described on p. 801.

Save Air-Hose Breakage by Using 45-Degree Taps on Manifolds

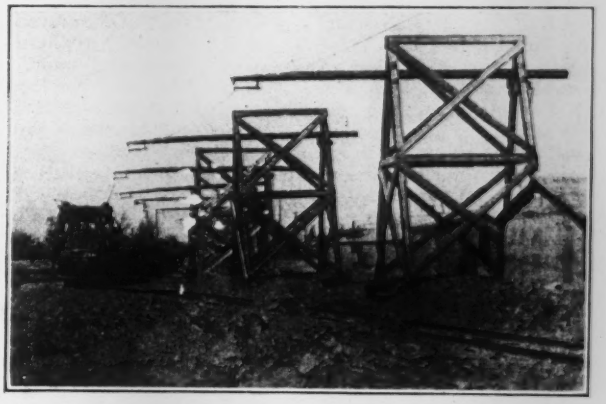
MANIFOLDS for compressed-air service in the Seattle North Pacific shipyard are made up in the shop at that yard with taps leading downward at an angle of 45 degrees, instead of at right angles to the standpipe as usual. This allows the hose to lead off downward without bending stress at the connection, and so greatly prolongs its life. The manifolds are usually made with 16 taps set in four rows of four each, 90 degrees apart. The diameter of the casting is made larger than that of the air main serving it, so the full volume is available for the taps. A globe valve is always put in with the manifold.

A pair of these manifolds is used to afford a flexible connection between the compressed-air lines aboard a ship lying at the outfitting pier, and a 4-in. lateral of the yard system. From the yard manifold 16 hoses are led, with ample length to allow for tide variations, to a similar manifold projecting over the ship rail.

Easily Adjusted Towers Support Offset Trolley Wires on Dump

HOW they keep the trolley wires away from the track center line, out of the way of shovels and locomotive cranes, move them around at will to follow the shifting tracks on a dump, and move the supports themselves with a minimum of difficulty, on the Queenston-Chippewa hydro-electric development (described on p. 801) is shown in the photograph.

The wires are supported on sliding arms carried by double A-frame towers mounted on wheels. The tracks under these towers are standard-gage, and the towers can be rolled on the main track like a hand car, and pulled anywhere on the work. They are mounted on planks at the side of the track when used in supporting the trolley wires, and are rolled forward as the dump moves out and the track is shifted. The arms which carry the trolley wires are movable by means of a sleeve nut and screw operated by a sprocket chain. This latter movement permits a very accurate and rapid final adjustment of the trolley wire. The scheme was devised by G. H. Angell, general superintendent, who has immediate charge of the construction work.



TOWERS ON WHEELS MAKE SHIFTING OF TROLLEY EASY

The offset trolley pole on the 50-ton electric locomotive is plainly shown in the photograph. As mentioned in the article referred to, the work is being done by forces of the Hydro-Electric Power Commission of Ontario.

Forestry Units' Methods in Use Here Before War

Similarity between the timber-handling methods of the American forestry units in France, as described by R. K. Tomlin, Jr., in the issue of Sept. 26, p. 566, and those in vogue in parts of this country, are pointed out by a correspondent. He states that the 35% incline operated by a donkey engine is an exact counterpart of the plant used by the contractor who some years ago built the large timber trestles on the western end of the Clinch Valley division of the Norfolk & Western Ry.; also that the sawmill illustrated on p. 568 is one of a number built at Buffalo and transported for use overseas.

NEWS OF THE WEEK

New York, October 31, 1918

Roads Burn Up in Minnesota Forest Fire

Peat Surfaces Formed from the Nearby Soil Are Destroyed—Great Loss of Life Caused Thereby

(From St. Paul Correspondent of Engineering News-Record)

Burning of the surfaces of many Minnesota highways was one of the peculiar incidents of the recent fire. The roads were built of peat dug from the ditches in obtaining drainage, and having dried out, were combustible. Great loss of life is said to have been caused on account of their becoming impassable.

The fire, which ranks as one of the greatest of forest fires in point of loss of life and property, comes next in this respect to the Michetive fire in New Brunswick in 1830. In the New Brunswick fire, from 1800 to 2000 lives were lost; while in this one, which occurred on Oct. 12 last, 1000 lives are reported to have been lost. The property damage is estimated at from $30,000,000 to $50,000,000.

Instead of being one large fire, this consisted of a number of separate fires, which were fanned by a wind of some 60 miles an hour. Thus several distinct areas are covered by this great disaster. In the main, these areas are long and narrow, which is explained by the high velocity of the wind driving them ahead, instead of allowing them to spread laterally. One of the fires started at Floodwood and ran east through Brookstown to Cloquet; another started some two miles farther north, extending eastward to Duluth. There was heavy loss of life in both of these areas. A third started near Lawler and swept southeasterly to Moose Lake. It was in this area that the greatest loss of life occurred. Other strips were burned over between these areas, and although they were not large, great damage was done to property, especially to peat farm lands.

Among the large property losses, that of the railroad companies was very great. It consisted of damage to culverts, depots, tie supplies, cars and burned-out peat roadbeds. According to newspaper reports, the losses of the Great Northern and Northern Pacific Railway companies was in the neighborhood of $500,000. The state also lost heavily in damage to its highways. Besides having the peat surfaces burned off, wooden bridges and culverts were destroyed. This prevented many people from escaping by means of automobiles, and added greatly to the loss of life. Many accidents are said to have oc-

(Concluded on page 825)

All Engineer Commissions Are Now Controlled By the General Staff

Candidates Must Make Application to Local Offices of New Personnel Branch, Which Procures All Army Officers

(Washington Correspondence)

Control of the procurement of officers for all the army's staff corps and departments is now centralized in the Personnel Branch of the General Staff, and separate recruiting endeavors of individual staff corps have been discontinued. This means that the Chief of Engineers must no longer be addressed in relation to prospective commissions in the Corps of Engineers, nor the Chief of Ordnance or the Quartermaster General for commissions in their respective corps. All staff commissions must now clear through the Chief of Staff. Line commissions—that is, in the infantry, artillery and cavalry—continue to fall under the order of Aug. 14, which requires induction into the service as privates of all candidates for line commissions within the draft ages of 18 to 45.

The new plan specifically applies to the Quartermaster Corps, Ordnance Department, Sanitary Corps, Engineer Corps, Military Intelligence Division, Motor Transport Corps, Construction Division, Department of Military Aëronautics, Bureau of Aircraft Production, Signal Corps, Chemical Warfare Service and Adjutant General's Department. It is intended to make regular announcements in the public press of the requirements in each of these branches of the service. When announcement is made of a need for which the civilian considers himself in every way qualified, he will communicate with the nearest office of the Military Training Camps' Association and there obtain complete information on how to apply. If found qualified, he will receive a standard application for commission in the United States Army, which he will need to fill out carefully and return to the Military Training Camps' Association office. These offices are located as given in the accompanying table.

SITUATION OF LOCAL MILITARY TRAINING CAMPS' ASSOCIATION OFFICES.

City.	Address.
New York City	19 W. 44th St.
Boston, Mass.	Room 330, 84 State St.
Philadelphia, Pa.	117 Commercial Trust Bldg.
Atlanta, Ga.	78 S. Pryor St.
Chicago, Ill.	Consumers Building
Cleveland, Ohio	37 Wade Bldg.
St. Paul, Minn.	1013 Pioneer Bldg.
Dallas, Texas	420 Interurban Bldg.
Kansas City, Mo.	New England National Bank Bldg.
Portland, Ore.	Corbett Bldg.
San Francisco, Cal.	1020 Mills Bldg.
Los Angeles, Cal.	Van Nuys Bldg., 210 W. 7th St.
Washington, D. C.	War Service Exchange, State, War and Navy Bldg.

Later, he will be interviewed and examined. In case the requirement which attracted him has already been filled or his qualifications make him more suitable for some other service, his application may be transferred or held, properly classified and available for use, in a deferred file. A civilian who considers himself qualified for service as a commissioned officer in any branch of the Army may, if he desires, make application through the nearest Military Training Camps' Association office in advance of any definite statement of a need for men with his particular qualifications. If found on interview and examination to be generally qualified to be an officer, he will be recommended as an available candidate for a commission, and his application will be forwarded to the Personnel Branch, General Staff, and there classified and either applied to a current need or held pending the development of future needs.

In no case, under the new procedure, is it desirable to travel or write to Washington, since all recruiting for civilians to be commissioned in the specified staff corps will be managed by the district headquarters of the Recruiting Subsection and the offices of the Military Training Camps' Association.

How Rules Affect Engineer Commissions

Engineering News-Record has been informed that the cases of all candidates for engineer commissions who have already been examined by the board which traveled over the country the past summer will be taken care of by the Corps of Engineers, but that others who made application for commissions, following the call for officers between the ages of 32 and 42, but who have not yet come before the board, must renew their applications under the new rules set forth in the beginning of this article.

There is still need for engineer officers in the United States Army. According to present rules, applications will be considered from any qualified engineer except those who are in Class 1A of the draft, or who would be in that class except for deferred rating

on account of industry, occupation or employment. These latter men must be inducted into the service as privates before they can be considered for officers. Other successful candidates will be commissioned and sent to officers' training camps with the pay and privileges of their rank. If there found unsuited for the service they will be given honorable discharges from the Army. Class 1A men, on the contrary, who as privates or noncommissioned officers are assigned to the training camps, must, if unsuccessful, return to their previous rank.

Shipyard Contract Canceled by Shipping Board

New Alameda Yard Out of Program—Ship Work to Be Concentrated—Barge Contracts Revoked

Announcement was made by Chairman Hurley of the United States Shipping Board Oct. 29 that the contract awarded to the new Alameda, Cal., yard of the Bethlehem Shipbuilding Co. has been cancelled. The yard has been constructing a plant with six shipways, to build 12,000-ton transports, but the Shipping Board now finds that the utilization of cargo ships and other large vessels for troop transport, and the increase in ship production, have made further transport-building facilities unnecessary. Present provisions for ships, it is stated, will meet all demands for Army movements under the present plan contemplating placing more than 4,000,000 men in France by June. There are 104 shipways in the United States capable of building vessels of the transport type, the Shipping Board states.

Further concentration of shipbuilding facilities is in prospect. The Shipping Board has made it clear that there will be no further extension of shipbuilding facilities, except possibly to build more concrete yards or more ways in the existing concrete shipyards. However, the least efficient wood shipyards and several steel shipyards that have not performed very efficiently are to be eliminated. As stated by Charles Piez, vice-president of the Emergency Fleet Corporation, in a press statement issued last Friday, revision of the entire shipbuilding program is in prospect, because of the great burden of expense of the present shipbuilding program and because the existing program does not fully meet the needs of the war.

Contracts for 50 wooden barges and 50 composite tugs designed for use in the New England coal trade have been canceled by the Shipping Board. No work had been started on these vessels.

Reduction in the amount of steel taken by the shipyards was announced by Director General Charles M. Schwab early in the week. The present allotment of 50,000 tons per week is stated to be more than is needed under the present labor-shortage conditions, and it is to be reduced by 10,000 to 15,000 tons.

Want Engineers as Sanitary Corps Officers

Enlarged Army Program Results in Call for Water-Supply and Municipal Men

For the purpose of meeting the requirements of a considerably enlarged program of service, both in the Army camps in this country and with the American forces overseas, the sanitary engineering section of the Sanitary Corps is in need of a number of officers of the following types:

Sanitary engineers of broad training and experience in water-supply and its purification, sewerage and sewage disposal, and other engineering activities related to public health; engineers with practical experience in drainage and mosquito-control operations; epidemiologists with good training in preventive medicine and qualified to institute and administer practical measures for the prevention or control of contagious disease; municipal health officers or sanitary inspectors with sound training in the fundamentals of sanitation, and with records of successful experience in handling men and in the sanitation of closely occupied areas, such as cities and industrial communities; water chemists and bacteriologists skilled in field and laboratory examination of water and with practical experience in water and sewage problems. The present and prospective work of this section will require the services of both commissioned and noncommissioned officers, and of a relatively small number of privates.

The program for which these men are needed comprehends several principal divisions:

1. A camp sanitary engineer is appointed in practically every Army camp in this country, or is to be appointed where not already supplied, to be on the staff of the camp surgeon, for advice and counsel with respect to all those phases of camp life in which either the physical structure of the camp or engineering operations connected with some camp activity have a bearing on the health and comfort of the command. In addition to these general duties, the camp sanitary engineers are specifically charged with the inspection and supervision of the operation of the camp water-purification and sewage-disposal plants, in much the same fashion as the operation of municipal plants of like nature is supervised by the engineering division of a good state health department.

2. In many of the camps, permanent labor detachments have been formed for the purpose of instituting and carrying into effective operation practical measures for the elimination of mosquitoes and flies, the proper disposal of manure, rubbish and other camp wastes, and the general sanitary improvement of the camp site. These detachments and their work in the camps are in charge of specially qualified officers of the sanitary corps, many of whom have seen active service in the sanitation of Cuba and the Canal Zone. It is the intention to extend this service to other camps not as yet covered, as rapidly as officers and facilities therefor are made available.

3. In many of the camps the services of officers classed as epidemiologists are required for special work in connection with the prevention or control of epidemic and contagious diseases. This work is not only investigational in character, but is more especially concerned with practical measures of prevention. It is the intention that this form of service in the camps shall be greatly extended.

4. Much of the practical work of sanitation of the areas in France occupied by the American Expeditionary Forces is accomplished through the agency or under the direction of the so-called "sanitary squads" (equivalent to the "sanitary sections" of the British service). Each of these small organizations consists of four noncommissioned officers and 22 specially selected privates, including, wherever possible, a carpenter or two, a bricklayer, at least two chauffeurs, concrete men, a pipe fitter, a plumber, an entomologist if one is available, an engineer, and several good "handy men," all of whom have received some training in the principles and practice of field sanitation. The squad is under the command of an officer of the Sanitary Corps, who directs all its operations and is responsible for its maintenance. A considerable number of these squads are to be organized in the near future, proportionate to the enlargement of the Army.

5. With each company of the water-supply regiments sent abroad by the Engineer Department, and with each Army division overseas, one Sanitary Corps officer is required for field inspection of water supplies.

A Reconstruction Plebiscite

Votes in favor of the Illinois $60,000,000 good-roads bond issue and the Chicago traction ordinance for an adequate system of rapid transit are urged by the Chicago *Tribune* in the platform printed daily for more than a month at the head of its editorial page. Both of the projects will provide extensive work and employment during the reconstruction period after the war. The public will vote on them on Nov. 5. The road project was discussed editorially and described, with a map, in *Engineering News-Record* Oct. 24, pp. 740 and 777.

American Society Leases Fifty-Seventh Street Property

The American Society of Civil Engineers has made arrangements to lease its property at 220 West 57th St., New York, to the Ajax Rubber Co., for $18,000 per year. This property was used as the headquarters of the society previous to the removal of the offices to the Engineering Societies' Building at 33 West 39th St. The 57th St. property had previously been given over to the use of the Food Administration.

Heavy Cantilever Girders Hauled by Teams

Fifty-six Horses Required to Pull Them—Special Trucks Used for the Work

Hauling cantilever girders weighing 73 tons on special trucks by means of 56 horses arranged in four-horse teams is being accomplished in transporting the girders from the boats at the waterfront to the Park Ave. viaduct near the Grand Central Terminal, New York. The girders are 136 ft. long and about 12 ft. deep at the supports. Because of their length and shape, many problems had to be solved in their transfer from the boats to the site. Missing the iron work street openings was impossible in many cases and considerable breakage resulted. A description of the viaduct was given in *Engineering News-Record* of July 11, p. 81.

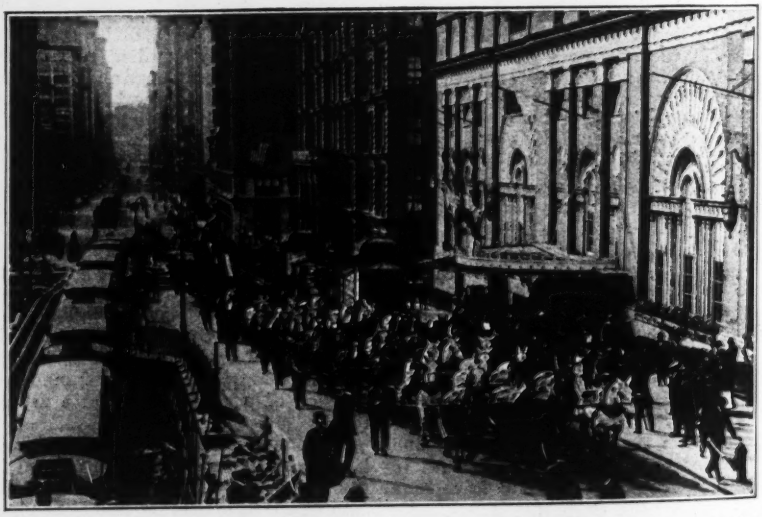
Photos by Edwin Levick, New York

GIRDERS ON TRUCKS TRUSSED WITH CABLES

Several routes for the transportation of these girders were considered, but it was finally found that the only street where they could be turned into Fourth Ave., which is a continuation of Park Ave. below 34th St., was at 23rd St., and the girders were therefore delivered at the pier on East River at 23rd St. This gave only one right-angle turn at 23rd St. and Fourth Ave., and, for the girders for the east side of the viaduct, one transfer crosswise of Park Ave. at 37th St., necessitated by the fact that no driveway exists on Fourth Ave. between 33rd and 34th Streets.

Two large trucks connected with a reach and 54-ft. centers were used as the running gear. The wheels for these trucks were made of cast steel with a tire width of 14 in. and a tire thickness of 3½ in., were placed 7½ ft. centers and 9 ft. out to out of the axles. Heavy bolsters were supported by these, upon which the girders were placed flat in such a manner as to distribute the load equally between the two trucks. To prevent bending of the girders they were trussed by means of wooden bents supporting two ⅞-in. cables attached to the ends of the girders and tightened up with turnbuckles. The trucks with a girder in place are shown in an accompanying illustration. Another illustration shows the 14 four-horse teams starting up a grade between 32nd and 34th Sts. The entire outfit covered a distance of 1½ blocks.

It was found that the heavy concentrations upon the wheels, amounting to nearly 20 tons including the running gear, had no respect for iron gratings and manholes in the streets. Where it was impossible to miss these they were generally broken down, and it was necessary for the public service companies to have repair gangs in attendance to repair them at once. Damage was also done to the street railway iron work and it is reported that the yokes supporting the rails and grooves for the underground trolley system were broken in many cases.



HORSES STARTING UP GRADE WITH GIRDER, THIRTY-SECOND STREET

Upon arriving at 23rd St. and Fourth Ave., special maneuvering had to be used to turn the corner. The method followed was entirely to pass Fourth Ave. until the tail of the girder was at the far curb line. The teams were then turned around, and their cable fastened to the head end of the girder. By pulling back with the front axle cramped the load was backed southward into Fourth Ave. until it was headed north. Considerable trouble was experienced in performing this operation, and severe damage was done to one of the corner buildings.

Little trouble was experienced in hauling the girders up Fourth Ave., with the exception that in some places the wheels sank into the asphalt block pavement and broke up the surface. In the case of one girder which accidentally ran over the curb at 32nd St., damage was done to the curb and sidewalk, the curb being forced down into the ground until even with the surface of the pavement and the sidewalk crushed and cut off as if with a knife. On the grade between 32nd and 35th Sts., it was necessary to use a 90-hp. motor hoisting engine to aid the horses.

Inasmuch as it was necessary to bring all the girders up the west side of Fourth Ave., and transfer those which were to go into the east side of the viaduct, at 37th St., special operations were necessary for this purpose. It was necessary to dismantle the parking at each side of the street to give clearance for passage of the girders which were pulled laterally to the other side. To accomplish the lateral transfer, the trucks were jacked up and the wheels placed in a cradle, made of large timbers about 12 ft. long and 3 ft. wide and shod with ⅝-in. sheet steel. Special grooves to fit the wheels were formed in the timbers. A track consisting of five steel rails attached to timbers was used as a track on which the cradles were rolled lengthwise of 35th St., the rollers being of solid steel, 12 in number and 2¾-in. in diameter.

In making the transfer the teams were removed and a motor truck was attached to a block and tackle snubbed into a manhole, and after the jacking had been done the movement was accomplished in 15 min. Having transferred them, they were jacked down and the teams proceeded to pull them to the site. Upon arriving at the head of the grade, running down to the Grand Central Terminal, the teams were again taken off and hoisting engines on the job working with cables were used both to pull the girders down the grade and keep them from proceeding too fast.

Arriving at the site they were hoisted into place by two large gallows-frames having steel caps consisting of two 20-in. I-beams from which were supported large five-sheave blocks.

The viaduct is being erected by the Terry & Tench Co. of New York, and the hauling was sublet to the Thomas McLarnon Trucking Co. of New York.

Minnesota Forest Fire

(Concluded from page 822)

curred, as people were retreating from the fire in the inky darkness caused by the smoke, through falls into these burned bridges and culverts.

Previous to this fire, and since 1893, the State of Minnesota has had five large forest fires; the Virginia fire in 1893, the Hinckley fire in 1894; the Chisholm and Grand Marais fires in 1908 and the Beaudette fire in 1910. Following the last named, the state appropriated money and established a State Forest Service. This was organized in 1911, W. T. Cox being obtained from the United States Forestry Service to take charge.

The original appropriation was $75,000 per year, but this had been subsequently cut down in 1915 to $40,000 and raised again in 1917 to $50,000, when the State Forester requested $150,000 as the minimum amount with which he could give the most meager service. To the smallness of these sums the present great disaster is laid by many. The value of the Forest Service is said to have been very well shown by this fire, the rangers and patrolmen working hard and at great risk.

The entire town of Cloquet, which has five of the largest sawmills in the world, and which is believed to have turned out more lumber than any other town in the world, was burned over, and the only thing that saved the inhabitants was the energetic work of the rangers who gave the alarm, and in an hour and a half arranged for the transportation of 8000 persons by means of automobiles and Northern Pacific trains to places of safety. The residential section of the town on one side of the river was burned entirely, while the mills on the other side were left unharmed. The people in the towns of Floodwood and Salina were also saved by the work of the rangers.

C. M. Babcock, state highway commissioner, J. H. Mullen, chief engineer, and J. T. Ellison, bridge engineer, are taking energetic means to repair the highways which have been destroyed. The cost to the state in putting out the fire and making repairs is estimated at more than $200,000.

The foregoing information is taken from an interview with W. T. Cox, state forester, who had just returned from the burned district.

Motor Truck Association of America Meets

Discusses Traffic Segregation and Various Desirable Changes in Present System

Segregation of traffic, as instituted by a recent order of the police commissioner of the City of New York and referred to editorially in *Engineering News-Record* of Sept. 12, was the subject discussed at a meeting of the Motor Truck Association of America, Oct. 23. It was brought out in the discussion that the truck mileage of some firms has been increased as much as 80% by this new ruling. The conditions on the Manhattan Bridge produced by the special segregation order made operative recently was also discussed. In opening the meeting, the secretary, T. D. Pratt, who had the chair in the absence of the president, stated that its purpose was to give an opportunity for an exchange of ideas and for asking questions.

Captain O'Connor of the city traffic department, in addressing the meeting, stated that he was without authority to say what changes were contemplated in the present rules by the department. He said that the system is now working satisfactorily from the point of view of the traffic department, but that there are individual cases of inconvenience which regulations may correct. The original idea was not to have the ordinance rigidly enforced to the inconvenience of business men, but was to keep the long-haul north-and-south traffic on certain streets. Policemen have orders not to arrest drivers who are on the wrong streets, nor to issue summonses for them, unless they repeatedly and flagrantly violate the rules.

It developed in the discussion that the rule was not being enforced reasonably in all cases, and that various patrolmen on the precinct squads interpreted it variously. This was particularly so with reference to trucks having deliveries along an entire street which is open to passenger traffic only. A patrolman at one corner will ask the driver where he is going, and the driver will answer, "Three blocks up." The officer will permit him to proceed, but when he comes to the next block, the patrolman there will force him to turn off and go to the next traffic street, up that, and over the block above, to arrive at his destination.

The inconvenience caused by the columns of the elevated railways on heavy traffic streets was also brought out. The trouble is occasioned by the inability of the trucks to dodge in and out among the columns, and this makes it advisable, according to the members, to use other streets for heavy traffic thoroughfares.

Conditions on the Manhattan Bridge were discussed by Nathan Mallouf of the Motor Haulage Co. The new regulations put into effect recently, which require all heavy traffic to go to the right, leaving the central portion of the drive for passenger vehicles only, has in some cases increased the period of time needed by trucks for crossing the bridge from 12 to 50 min. or even an hour. Twenty-five to 30 minutes is the minimum time for a truck to make the trip at present, according to Mr. Mallouf. This is due to the mixing of slow horse-drawn vehicles with the motor trucks, with no chance for passing. Various means of eliminating the interference were suggested.

Assurance was given that changes would be made in the traffic regulations in the near future, and the secretary was authorized to write a letter to the Police Commissioner setting forth the recommendations of the association.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

CITY MANAGERS' ASSOCIATION; Harrison Grey Otis, Auburn, Maine, secretary-treasurer; Nov. 6-8, Roanoke, Va.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS; A. Dennis Williams, Morgantown, W. Va., acting secretary; Dec. 2-6, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York City; Dec. 3-6, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston; Dec. 9, Chicago.

The Florida Engineering Society will hold its annual meeting at Jacksonville, Jan. 6, 1919.

The International Concrete Ship Association elected the following officers at the first annual meeting of the association, which was held in New York City: President, Victor C. Coxhead; vice-president, Russell B. Smith; secretary, H. F. Cuntz, 7 East 42nd St., New York City.

The Cornell Society of Civil Engineers elected the following officers at the annual meeting held Oct. 15: President, E. J. Moore, vice-president and chief engineer of the Turner Construction Co.; first vice-president, Charles S. Rindsfoos, secretary of the Jarrett-Chambers Co.; corresponding secretary and treasurer, E. A. Truran.

The Association of Russian Engineers for the Relief of Russia has been organized in New York City, as announced Oct. 28 by C. H. Ozols, president of the association. The organization comprises a group of Russian technical engineers, who were sent to

America by the former Russian Government to study American industrial methods, and who found it impossible to complete their work under the Bolshevist régime. The association plans to do all in its power to assist in interpreting American methods, institutions and characteristics to the Russian people, according to Mr. Ozols.

PERSONAL NOTES

CHARLES D. WEIRBACH, sanitary engineer, United States Shipping Board, and previously city engineer of Allentown, Penn., has been commissioned in the Quartermaster Corps as a captain and assigned to duty as assistant to the chief of the Construction Division. Captain Weirbach was city engineer of Allentown for 12 years and resigned in February to become sanitary engineer on the staff of Admiral Bowles of the Emergency Fleet Corporation. In this capacity Captain Weirbach had charge of the sanitation and health service of the fabricated shipyards of the American International Shipbuilding Corporation at Hog Island and the Merchant Shipbuilding Corporation at Bristol, Penn., and until recently of the Submarine Boat Corporation at Newark, N. J.

E. E. HOWARD, of Harrington, Howard & Ash, consulting engineers, Kansas City, has been commissioned in the Corps of Engineers with the rank of captain and has been temporarily assigned to duty at Fort Benjamin Harrison.

GEORGE W. HAND, valuation engineer, Chicago & North Western Ry., has been appointed corporate engineer. Valuation work will be handled in various departments, part by the operating department and part by the corporate officials.

PROF. CHARLES H. DOW, mechanical drawing department, Mechanics Art High School, St. Paul, has become an instructor in the Students' Army Training Corps, University of Minnesota, in charge of field engineering and mapmaking.

ALBERT B. GIDLEY, Marshfield, Ore., previously of the firm of Moon & Gidley, contractors of that city, has been commissioned as a captain in the Corps of Engineers.

F. C. PURCELL, assistant valuation engineer, Chicago & Eastern Illinois R.R., has received a commission as first lieutenant in Company A, Third Provisional Battalion, Engineers, Miscellaneous Personnel.

J. B. LIPPINCOTT, Los Angeles, who was previously on the engineering staff of the Los Angeles aqueduct and is now engineer for Hampton & Co., has been assigned to the Neville Island housing project, near Pittsburgh, in connection with the building of 3500 brick houses for employees of the Government ordnance plant.

W. JOCELYN E. DALE, chief engineer of power installations, Matahambre Copper Mines, Cuba, has been appointed superintendent of power, with offices at Minas de Santa Lucia, Pinar del Rio, Cuba.

E. PAUL FORD, previously city engineer of East San Diego, Cal., and engineer for the San Diego Securities Co., has been commissioned as first lieutenant and assigned to duty with the 403rd Engineers, at Fort Douglas, Utah.

J. F. DRUAR, consulting engineer, St. Paul, has been commissioned in the Corps of Engineers as a captain and assigned to duty at Camp Dodge, Iowa.

F. RINGER, formerly chief engineer of the Missouri, Kansas & Texas Ry., has been appointed chief engineer for the corporation.

J. H. A. BRAHTZ, consulting engineer, St. Paul, has been appointed instructor in mechanics, Students' Army Training Corps, University of Minnesota. Mr. Brahtz will, however, continue his practice.

SAMUEL H. LEA, Portsmouth, Va., has become field engineer for the Hill & Ferguson Co. on the Paradise Creek housing project near that city.

MAJ. HENRY S. SPACKMAN has been promoted to the rank of lieutenant-colonel, assigned to duty in the Corps of Engineers.

R. W. HAWLEY, hydraulic engineer of the California State Railroad Commission, has been commissioned as a captain in the Corps of Engineers and assigned to duty at Fort Douglas, Utah.

CAPT. C. R. FORBES, Corps of Engineers, previously professor of mining engineering, Rollo School of Mines, Missouri, has been promoted to the rank of major and is now stationed at Camp Shelby.

C. V. JOHNSON, chief engineer of James Gosselin, Ltd., engineers and contractors, Quebec, Canada, has resigned to become associated with The Foundation Co., Ltd., Montreal.

GEORGE BAKER, assistant city engineer, Dayton, Ohio, has been commissioned as a first lieutenant, Corps of Engineers.

H. C. WESTOVER, engineer for the Board of Education, St. Joseph, Mo., has been commissioned as a captain in the Corps of Engineers.

OBITUARY

MAJ. ALEXANDER P. CRONKHITE, 203rd Engineers, son of Major General A. Cronkhite, was killed at Camp Lewis, Washington, Oct. 25, by an accidental shot in pistol practice. He was graduated from West Point in 1915, and until recently was instructor at the Engineer Officers' Training School, Camp A. A. Humphreys, Virginia.

CHESTER P. SIEMS, head of the Siems-Carey Railway & Canal Co., died at his home in New York City Oct. 23, in his thirty-fourth year. He was born at St. Paul and was graduated from Yale in 1907, after which he entered the engineering department of the Spokane, Portland & Seattle Ry. In 1908 Mr. Siems joined his father in forming the firm of Siems & Co., for carrying out large construction programs for the Great Northern and the Northern Pacific Ry. In 1911 the firm was converted into the Siems-Carey Co., and Mr. Siems was elected president. In February, 1912, the Marsh-Siems-Carey-Smith Co. and the Siems-Carey, Ltd., both construction companies, were launched, and carried out contracts for the Chicago, Milwaukee & St. Paul, Grand Trunk, and the Canadian Pacific Rys. Mr. Siems in 1916 established the Siems-Carey Railway & Canal Co. It had a contract for 2000 miles of railroad construction in China, against which protest was made by the Japanese Government and it was postponed.

WALTER JAMES, who was consulting engineer for the Kern County Land Co. of California for 46 years, died in Los Angeles Oct. 13 at the age of 82. Mr. James went to Bakersfield, Cal., in 1872, and became engineer for Haggin & Carr, who were the predecessors of the Kern County Land Co., during the period of canal construction in Kern County.

KENNETH BERTRAND TURNER, assistant professor of theoretical and experimental hydraulics, college of civil engineering, Cornell University, died at Oswego, N. Y., Oct. 21, at the age of 36. He was graduated with the degree of civil engineer from Cornell in 1903, obtaining his master's degree in 1905. After two years' service on the United States lake survey, he became a member of the faculty of the College of Civil Engineering. He did much research work in hydraulics.

DANIEL BARTON ROGAN, maintenance engineer, Port Commission, New Orleans, La., died in that city Oct. 10. At the time of his death he was chairman of the committee of mechanical progress of the Louisiana Planters Association.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

War Service Committees Aiding Washington

Transmit Government Requirements to Industries and Coöperate with War Board

War service committees, representing various industries, are acting as a channel of communication between the Government and those industries. The committees were formed under the direction of the building material section of the War Industries Board, as outlined on p. 811 of this issue, and are composed of representatives of the producers in the fields covered by the committees. Each committee has a chairman, a secretary and a Washington representative. The powers of the secretary and Washington representative in most cases are centered in one man. A tabulation of the committees, with the names of the secretaries and Washington representatives or chairmen, is shown herewith.

Industrial War Service Committees

Name of Committee	Secretary, Washington Representative or Chairman	Address
Architectural Terra Cotta	W. A. Mills, Washington Representative	729 15th St., N. W., Washington, D. C.
Automatic Sprinklers	Henry B. Cross, Sec. and Washington Representative	821 Munsey Bldg., Washington, D. C.
Brick	R. D. T. Hollowell, Sec. and Washington Representative	20 McLean Bldg., 1517 H St., N. W. Washington, D. C.
Building Hardware	Hartwell A. Taylor, Sec. and Washington Representative	1218 New York Ave., Washington, D. C.
Building Stone	Chas. T. Vandeveer, Sec. and Washington Representative	626 Colorado Bldg., Washington, D. C.
Cast Iron Boilers and Radiators	Frederick W. Herendeen, Chairman	Geneva, N. Y.
Cement Concrete Pipe	A. M. Firsh, Chairman	Lock Joint Pipe Co., Ampere, N. J.
Clay Roofing Tile	J. K. Webster, Sec. and Washington Representative	615 Union Trust Bldg., Washington, D. C.
Clay Sewer Pipe	Geo. H. Tefft, Sec. and Washington Representative	311-312 Homer Bldg., 13th and G Streets, Washington, D. C.
Composition Roofing	Stewart F. Perry, Sec. and Washington Representative	510 Munsey Bldg., Washington, D. C.
Concrete Reinforcement	A. E. Lindau, Sec. and Treasurer	Mutual Life Bldg., Buffalo, N. Y.
Door Hangers and Track	W. P. Benson, Chairman	Sterling, Ill.
Electrical Materials	J. C. Dallam, Chairman	General Elec. Co., 1 River Road, Schenectady, N. Y.
Elevators	J. H. Van Alstyne, Sec.	Otis Elevator Co., New York, N. Y.
Fiber Wall Board	Carl G. Whattler, Washington Representative	Raleigh Hotel, Washington, D. C.
Gypsum and Gypsum Products	V. G. Marani, Washington Representative	415 Woodward Bldg., Washington, D. C.
Hollow Building Tile	E. R. Sturtevant, Sec.	631 Pennsylvania Ave., Washington, D. C.
Illuminating Glassware	James Lewis, Sec.	Consolidated Lamp and Glass Co., Coropolis, Penn.
Lighting Fixtures	Wm. Horn, Sec.	427 N. Broad St., Philadelphia, Penn.
Lime	Henry M. Camp, Sec. and Washington Representative	Riggs Building, Washington, D.C.
Metal Corner Beads	F. E. Sagendorph, Sec. and Washington Representative	301 Colorado Bldg., Washington, D. C.
Metal Lath	Zenas W. Carter, Chairman and Washington Representative	925 Woodward Bldg., Washington D. C.
Millwork	Geo. J. Osgood, Sec. and Treas.	228 Munsey Bldg., Washington, D. C.
Mineral Aggregate	E. Guy Sutton, Sec. and Washington Representative	104 District National Bank Bldg., Washington, D. C.
Plate Glass	Charles W. Brown, Chairman	Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, Penn.
Plumbing Supplies	George Herth, Jr., Washington Representative	Southern Bldg., 15th and H Streets N.W., Washington, D. C.
Portland Cement	H. I. Todd, Washington Representative	427 Colorado Bldg., Washington, D. C.
Sand Lime Brick	Allen Walton, Sec.	Hummelstown Brownstone Co., Waltonville, Penn.
Steel Sash	V. F. Dewey, Chairman	Detroit Steel Products Co., Detroit Mich.
Slate	Arch. M. Jones, Sec. and Washington Representative	711 13th St., N. W., Washington, D. C.
Tiling	F. W. Walker, Chairman	Beaver Falls Art Tile Co., Beaver Falls, Penn.
Weather Strips	Jos. R. McCarger, Chairman	American Metal Weather Strip Co., Grand Rapids, Mich.
Window Glass	C. Ellsworth Parker, Washington Representative	301 Star Bldg., Washington, D.C.
Wire Glass and Ribbed Glass	Walter Cox, Chairman	Pennsylvania Wire Glass Co., 944 Pennsylvania Bldg., Philadelphia, Penn.
Wire Screen Doors and Windows	Jas. B. Henderson, Sec. and Treas.	1319 W St., N. W., Washington, D. C.

Quartermaster General Compiling List of Bidders

The office of the Quartermaster General is compiling a list of bidders on all articles purchased by the Quartermaster Corps. It is stated that the list is for the purpose of maintaining a closer relationship between the manufacturing and business concerns of the country and the procurement division of the office of the Quartermaster General.

The list is composed of names of companies doing or bidding on work for the Quartermaster General's office, or for the quartermaster depots throughout the country, and the names of those manufacturers and companies which make application for a place on the list will be added. It is expected that when the work is completed there will be at the disposal of the procurement officers of the office of the Quartermaster General a list of firms which produce all of the articles and materials needed by the corps. It will enable the procurement officers to keep in close contact with the manufacturers in connection with proposed purchases and requirements, without interfering with the present method of advertising and publicity, for Quartermaster Corps purchases.

Time-Recording Device for Motor Trucks

The time-recording device for motor trucks, an article on and illustration of which appeared in *Engineering News-Record* of Oct. 10, p. 694, is manufactured by the Service Recording Co., East 105th St. and Quincy Ave., Cleveland, Ohio.

Structural Steel Contracts Sixty Per Cent. of Shop Capacity

The secretary of the Bridge Builders' and Structural Society announces that during September 60 per cent. of the entire capacity of the bridge and structural shops of the country was contracted for.

Announcements from the Emergency Fleet Corporation state that the shortage of labor was restricting the shipbuilding activities to such an extent that, for a certain period, from 10,000 to 15,000 tons of steel allotted to shipyards would be released each week for other war industries. The 50,000 tons a week assigned to shipbuilding, it was said, proved to be beyond the needs of the plants.

Time Limit Proposed for Suits on Commandeered Property

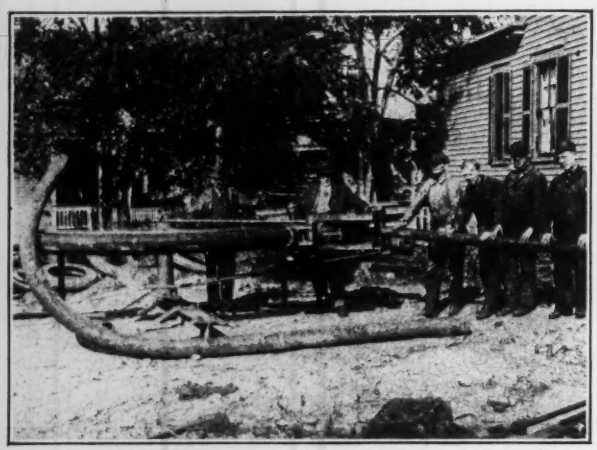
The War Department has recently sent to Congress a recommendation for the enactment of a special statute of limitation reducing from six years to four months the time in which dissatisfied owners of plants commandeered by the Government may resort to the courts for adjustment of claims. The bill covers engineering or shipbuilding plants, shipyards, vessels, mines or any other property seized for Government use.

The Washington representative of the National Federation of Building Industries, in bringing this matter to the attention of the various industries concerned, states that "there seems to

be little reason for their forcing immediate action on all cases of this character. The existence of the war offers no reason for shortening the time for bringing suit. On the contrary, it is a reason for extending it." He points out that various laws extending the time limit were passed during the Civil War and cites the recent soldiers and sailors' relief act. He concludes that Congress should either leave the existing six-year limitation as it is now or, if it is going to enact a shorter time, should make it effective at the end of the war and for longer than four months.

Reducing Cost of Bending Pipe

In an effort to reduce the cost of bending pipes from 4 to 6 in. in diameter, the machine shown in the attached illustration was designed to perform these operations on the pipe without resorting to heat. The manufacturers state that in a recent test made in Massachusetts a 6-in. pipe was bent to a 90° turn by six laborers working but 9½ min. The makers point to the difference in cost between this and the usual charge made by the average pipe bending companies. The machine is known as the Model C Hercules "Wonder" pipe-bending machine, and is manufactured by the American Pipe Bending Machine Co., Boston, Mass.



MACHINE BENDS PIPE WITHOUT USE OF HEAT

Manufacturer Is Chief of Procurement Division, Ordnance Corps

Lieut. Col. Robert P. Lamont, formerly president of the American Steel Foundries Co. of Chicago, has been appointed chief of the procurement division of the Army Ordnance Department. Immediately prior to this appointment, Lieutenant Colonel Lamont was head of the raw materials section of the Procurement Division, having been commissioned in the Ordnance Department Feb. 4, 1918. He succeeds Brig. Gen. Samuel McRoberts, who in civil life was executive manager of the National City Bank of New York, and is assigned to France to take up work with the army abroad.

"Conserve Condenser Tubes," Is War Board's Warning

A shortage of condenser tubes and repair materials, due to the heavy requirements of the Navy and the Emergency Fleet for nonferrous condenser tubes, has become such as to call forth a warning from the War Industries Board. The board emphasizes the seriousness of the situation to all the industries using condensers, and urges upon them the necessity of conserving their condenser tubes.

Convention To Represent 300 Industries Planned

A convention representing 300 industries, and which will probably bring together 3000 delegates, for the purpose of promoting productivity, both during and after the war, has been planned by the Chamber of Commerce of the United States. The convention will be held at Atlantic City December 4, 5 and 6.

According to D. A. Skinner, assistant secretary of the Chamber of Commerce of the United States, the National Chamber of Commerce has been organizing the industries of the entire country at the instance of the War Industries Board. The chamber issued calls to specific lines of industries to meet in Washington, where they are organized under the head of the War Service Commission, and they are being classified under various Federal departments to work with them directly in bringing about wider activties.

Reconstruction and a centralized scheme of organization are among the subjects to be considered.

Motors and Vehicle Division Places $130,000,000 Order

An order amounting to approximately $130,000,000 for vehicles of various kinds, principally motor-driven, has been placed by the motors and vehicle division of the office of the Director of Purchase and Storage to supply the recently-organized Motor Transport Corps. It is stated that the order is the largest ever given by the Government for such equipment.

The order includes more than 1600 motor trucks of from 1½-ton to 3½-ton capacity, more than 10,500 chassis of 1½-ton to 5-ton capacity, and more than 3600 trailers. Nearly 10,000 passenger automobiles were ordered, and more than 18,000 motorcycles and 25,000 bicycles.

Business Notes

C. C. Stedman, formerly general manager of the Cook Motor Co., has been appointed standardization engineer for the Allied Construction Machinery Corporation. He will undertake the standardization of the lines, construction and material-handling machinery made by the manufacturers associated in the Allied Machinery Corporation for export trade.

Edgar P. Kable, formerly assistant secretary of the York Water Co., York, Penn., has been elected general manager of the company. Mr. Kable is an active member of the American Water-Works Association and the Pennsylvania Water-Works Association. The York Water Co. is one of the oldest water companies in Pennsylvania and was one of the first to use mechanical filters.

The H. W. Clark Co., manufacturer of the Clark meter box, Mattoon, Ill., is erecting a modern fire-resistive plant to replace the one destroyed by a tornado last year.

Roland S. Fend & Co., 122 South Michigan Ave., Chicago, Ill., have been appointed Chicago managers of the National Equipment Corporation, Philadelphia.

Trade Publications

The Yarnall-Waring Co., Chestnut Hill, Philadelphia, has issued a loose-leaf catalogue, "Engineering Devices for the Power Plant, Yarway Products." The pages contain line cuts, half tones and descriptive specifications of the various devices made by the company.

The Carbolineum Wood Preserving Co., 34 Greene St., New York, has issued circular No. 87, on the value of timber preservation; it shows the method of application of "Protexol" as a wood preservative.

The Jeffrey Mfg. Co., Columbus, O., has published bulletin No. 246, illustrated with half tones, showing the uses of the Jeffrey pit-car loader in coal mines. It is stated that the bulletin will be sent on request.

The Barrett Co. has issued a new booklet, "Tarvia for Private Estates." It is illustrated by half tones from views of private estates wherein walks and roadways have been treated with Tarvia.